Agricultural Research Institute

PUSA

CONTENTS.

TRANSACTIONS

OF THE

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

PRELIMINARY NOTICE.

In issuing the usual Preliminary Notice prefixed to each new volume of the Transactions, the Directors are enabled to report the progressive prosperity of the Society. Though many of its earlier members are disappearing, its numerical strength is annually on the increase, and its roll now contains 3658 names.

Finance.—The financial position of the Society is equally satisfactory. In 1846, it was found that the expenditure had been in excess of income, and that no provision had for some time been made to fund, in terms of the Charter, a portion of each year's life-compositions. The Directors of the day were consequently compelled to encroach considerably on the capital of the Society in order to clear off encumbrances. Not only has the sum then withdrawn been replaced, but a large additional amount has been funded, and the Society stands, financially, in a position at which its successive Directors have long aimed. The interest of its realised capital is now sufficient to cover the whole cost of the establishment and all other fixed expenses, leaving the income, arising from the subscriptions of members, available for promoting the general objects of the Institution. It may be asked,—Why, under such circumstances, continue to accumulate? But the Charter makes it imperative to set aside a certain portion of each life-composition as a substitute for the annual subscription which it extinguishes, and, owing to the fluctuating amount of compositions paid in different years, the expenditure of the Society could not be regulated were these spent as received. It must be obvious that, had the practice been immediately to expend the whole amount paid in

lieu of an annual subscription, the position of the Society would now be precarious, and its income limited to the annual payments of less than one-third of its members. In these circumstances, the Directors have deemed it to be their duty to implement the regulation requiring one-third of each year's compositions to be funded.

An impression having gone abroad that the amount owing by members in arrear is large, the Directors, while on the subject of finance, may mention, as a fact creditable to so large a constituency, that the arrear-list represents a sum of only £152, 6s. 6d. It has ever been the practice of the Directors indulgently to consider any application for relief from payment, but, on the other hand, when persons refuse to continue their subscriptions without assigning any reason, as in a few instances is now the case, they are compelled, in justice to the other members of the Society, to exercise the compulsory powers with which they are armed by the Charter.

GENERAL SHOWS.—Since the date of the last Preliminary Notice in July 1857, general shows have been held at Glasgow and Aberdeen. The limits of this paper do not admit of a detailed report of these meetings, but the following abstract will serve to show their character and extent, in comparison with the preceding show at Glasgow in 1850, and at Aberdeen in 1847:—

GLASGOW.	1850.	1857.	ABERDEEN.	1847.	1858.
Cattle,	484	415	Cattle,	361	450
Horses,	164	240	Horses,	105	189
Sheep,	639	669	Sheep,	230	590
Swine,	85	112	Swine,	24	79
Poultry,	172	429	Poultry,	102	366
Dairy Produce,	316	234	Implements and Machines,	49	802
Implements and Machines,	577	610			
	2437	2709		871	2476

The meeting for the current year is in an advanced state of preparation for Edinburgh, and the Society is under engagements at Dumfries in 1860, and at Perth in 1861.

The Directors are happy to have it in their power to state that the mode of raising subscriptions in aid of a show by a uniform rate on the rental of a county, is now nearly in universal practice. It was acted on in the Glasgow and Aberdeen districts; it is now in operation in the Lothians; and the counties associated for Dumfries have resolved to adopt it. Not only does this system mark the interest which the proprietors of Scotland take in these meetings, and their desire to support them, but it is more in harmony with the national character of the Society than a private subscription, while an ample fund is raised by means of it without annoyance or trouble, and, in consequence of the universality of its application, at a small cost to individuals. The Directors are bound to express their thanks

for the support which has thus been liberally accorded, and to state that the instances in which payment of the rate has been repudiated form rare exceptions.

In November 1858, a general committee, embracing agriculturists from the principal districts of Scotland, was appointed for the purpose of considering the whole system of shows, and of revising the regulations under which they have hitherto been conducted. An elaborate report was presented to the Directors, and published in the last number of the Transactions. It contained many suggestions, some of which involved material alterations, and, so far as these did not interfere with what had officially been announced for the meetings of 1859 and 1860, the Directors resolved to give effect to them experimentally at Edinburgh, with the view of enabling the Society to judge how far their permanent adoption may be desirable. The principal changes consist in the exclusion of all exhibitors from the yard while the judges are occupied with their duties—placing the stock under cover—extending the duration of the meeting—providing additional time for the inspection and trial of implements—and admitting farm-servants, belonging to the district of the show, at a reduced rate. Some of these alterations will necessarily add to the expenses of a show, more particularly in regard to the erections within the yard, and the Directors have consequently been obliged to adopt certain charges for the purpose of assisting to defray the cost of the accommodation now to be furnished to exhibitors of stock. It should be understood, however, that these fall considerably short of what the Society has itself to pay, being generally from one-half to two-thirds of the contract price, and in many instances, it is believed, less than exhibitors have been wont to pay for stable or byre accommodation in the vicinity of the yard. A further alteration has been made as respects the mode of suggesting judges: this duty was formerly discharged by a committee in connection with the Directors, it has this year been tentatively devolved on a body of about eighty farmers representing every county, to whom printed schedules have been sent, and whose returns will be submitted to a smaller committee of selection.

Local Competitions—An early and distinctive feature of the Society's proceedings is its connection with the Local Agricultural Associations, and the encouragement thereby afforded to district competitions in all parts of the country. The Directors continue to regard this as one of the most important and useful departments of the Society. Irrespective of the pecuniary assistance which it enables them to lend to rising associations, or to those which may be under temporary depression, it serves to maintain a friendly correspondence between the central body and its offshoots, and gradually to engraft on the practice of the latter that system of competition and those regulations which the experience of the former has established. The Directors have accordingly considered

it to be their duty to extend, with the increased financial means of the Society, the sphere of their operations in connection with local associations, and they have now competitions for stock of different kinds arranged in above fifty districts, besides offering encouragement in the shape of honorary medals in a still greater number. During the current year these competitions will call into operation premiums to an amount of above £1500.

BYE-LAWS.—The bye-laws enacted under the Charter for the regulation of the Society's business, were, with an exception relating to the admission of tenant-farmers, all passed either in 1834 in furtherance of the Charter then obtained, or in 1846, after the death of Sir Charles Gordon, and before the election of his successor. Those of 1834 were printed along with the Charter of that date, but the others are merely recorded in the minute-book, and inconvenience has been experienced from the difficulty of referring to them in that shape. In some instances, besides, the practice of the Society had to a certain degree outgrown a few of the older enactments; and the Directors, therefore, deem it desirable that the Charter should be reprinted for the use of members, with a complete code of bye-laws, so revised and amended as to bring them into harmony with the various changes which have come into operation since 1834, and at the same time to provide for certain additional enactments which the Directors mean to submit to the next general meeting. These relate principally to publishing, previous to the January meeting, a list of the office-bearers to be proposed in place of those who annually retire in rotation, and the abstract of the preceding year's accounts, in greater detail than was formerly given. The Charter requires the authority of two consecutive general meetings to legalise any alteration on or addition to bye-laws, and with the view of obtaining this, the sanction of the June meeting will be applied for in favour of the laws as revised and adjusted by the committee specially appointed by the Directors for that purpose. Besides the bye-laws in connection with the General Charter of 1834, there are those for the regulation of agricultural education under the Supplementary Charter of 1856, which have been published, and on which no change is proposed.

CHEMICAL DEPARTMENT.—The Directors regret to observe a tendency on the part of some of those who have hitherto supported this department, to withdraw their subscriptions. They would earnestly inculcate the necessity of maintaining its efficiency, and of not permitting any apparent indifference to detract from that sense of its importance which it is desirable to maintain in the mind of the agricultural public. By means of the subscription which has been in existence since 1850, the Laboratory has been conducted on terms which afford to members of the Society great facilities and advantages for procuring that advice which it is so much their interest to obtain. The extent to which adulterated manures are sold in Scotland, and the loss consequently entailed on

farmers, are notorious, and it is to be regretted that they do not more universally avail themselves of the opportunities afforded of protection, considering that for a fee of five shillings a guano can be so tested as to establish whether it tallies with the analysis by which it has been purchased, or that the soluble and insoluble phosphates of a superphosphate can be determined for ten shillings. Dr Anderson, as it is, has been instrumental in detecting many instances of adulteration and attempted imposition, and in saving from heavy pecuniary loss those members by whom he was consulted. He has further carried through a vast amount of work in the Laboratory, embracing, in addition to manures, analyses of soils, limestones, waters, and oil-cakes; laborious investigations of the varieties of different cereals, besides numerous contributions to our knowledge of the composition of cattle-foods, and much valuable matter published in the Transactions, the last volume of which contains nearly 100 pages from his pen. In these circumstances the Directors would repeat an expression of their hope that no aid hitherto accorded to the chemical department will be withdrawn.

AGRICULTURAL EDUCATION.—The Charter authorising the Society to confer agricultural diplomas was obtained in 1856, and its provisions, and relative bye-laws, were fully explained in the Preliminary Notice attached to the volume of the Transactions commenced in July 1857. The first examination was held in April 1858. Three candidates presented themselves, but only one, Mr Jacob Wilson, Manor House, Morpeth, was found entitled to the diploma. In April last, eight candidates inscribed their names for examination, of whom six appeared, when the diploma was again conferred on the following students:—

1. John Milne, Mains of Laithers, Turriff; 2. William Henry Eley, Cobham, Kent; 3. Thomas Rome, Groundslow, Stone, Staffordshire.—Mr Hewens Walton, Fenny Compton, Warwickshire, passed a most creditable examination on the scientific branches, but being under twenty-one years of age he cannot be taken up on the practical department, nor obtain the diploma, till he has attained that age.

Hitherto the only test has been examination, but in future the observance of a prescribed curriculum is essential; and for the information of those interested, the following extract from the Report by the Council on Education may be repeated, as explanatory of the course of study, and the nature of the examinations:—

The Council consider that in organising the proposed system of education, there are two leading points to be attended to: 1st, The offer of every proper encouragement and facility to induce and enable agricultural students to become candidates for the Society's diploma; 2dly, The enforcement of stringent precautions to guard against the possibility of the powers created by the Charter being abused, or the diploma being conferred on insufficient grounds.

The Committee conceive that a well-defined curriculum will serve as a guide to the young agriculturist, both as regards the subjects of study and

the order in which they are to be pursued; and that its observance will afford the best guarantee for an education worthy of the diploma. This education must be of a twofold character, scientific and practical—the one to be acquired in the class, the other on the farm; and the sufficiency of both should be tested—1st, By evidence of attendance for prescribed periods in the class and on the farm; 2dly, By a rigid and searching examination after the required attendance has been completed.

In addition to a perfect knowledge of the principles of husbandry, and of the details of practical farming, a candidate should be conversant with those departments of the following branches of study which bear upon agriculture :—

1. Chemistry, scientific and applied.
2. Natural History, including the Principles of Zoology and Geology.
3. Botany.
4. Veterinary Medicine and Surgery.
5. Technology, or Industrial Science in its bearings on Agriculture.
6. Field Engineering and Surveying.
7. Mechanics and Architecture, in so far as regards a knowledge of their use and application to the operations and buildings of the farm.
8. Book-keeping and Accounts.

While candidates are not tied down to any particular college or seminary, they should be required to exhibit certificates of attendance for prescribed periods at the following classes in some educational institution, approved of and recognised by the Examiners as sufficient:—Agriculture, Chemistry, Natural History, Botany, and Veterinary Medicine and Surgery. Acquirements in Technology, Field Engineering and Surveying, Farm Mechanics and Architecture, and Book-keeping, may be established by examination, without certificate of attendance, but students should nevertheless take advantage of whatever classes may be available for these branches.

Students should not be restricted in their attendance to any particular part of the country or style of farming; but power should be reserved for the Examiners to judge of the sufficiency of the certificate produced, and of the competency of the party granting it.

The whole course of study should embrace not less than four years—two at classes, and two at the farm; and students should be strongly recommended to pass through the scientific departments first, so as to enter on the practical part with the advantages and the aids derivable from a proper education.

When the scientific course is preferred in point of time, a student may be examined upon it before going to the farm.

A student may take alternate years of the classes and of the farm, but it should not be permissible to devote to either less than an entire year at a time.

No part of the course should commence until the student is seventeen years of age, and consequently a diploma cannot be granted until he is twenty-one.

The following appears to be a suitable arrangement for the scientific course :—

First Year.

Summer—Natural History, 3 months; Botany, 3 months.

Winter—Agriculture, 6 months; Chemistry, 6 months; Veterinary Surgery, 6 months.

Second Year.

Summer—Natural History, 3 months; Analytical Chemistry, 3 months.

Winter—Agriculture, 6 months; Technology, 6 months; Agricultural Engineering, Architecture, and Surveying, 6 months.

This arrangement is merely suggested as providing a proper course of study and succession of subjects, but the student need not be prohibited from adopting another order, provided he proves attendance for the prescribed periods at the specified classes.

In pursuance of this Report, the following bye-laws have been enacted:

1. That in terms of a Report by the Council on Education, the following Board of Examiners be appointed:—

Science and Practice of Agriculture—Mechanics, and Architecture of the Farm—Professor JOHN WILSON; JOHN FINNIE, Swanston; ROBERT RUSSELL, Edinburgh and JOHN WILSON, Edington Mains.

Botany—Professor BALFOUR.

Chemistry—Professor THOMAS ANDERSON.

Natural History—Professor ALLMAN.

Technology—Professor GEORGE WILSON.

Veterinary Surgery—Professor DICK.

Field Engineering and Surveying—JOHN MILLER of Leithen, C.E., and JAMES STIRLING, C.E.

Book-Keeping and Accounts—KENNETH MACKENZIE, Accountant, and PETER M'LAGAN, yr. of Pumpherston.

2. That it shall be competent for said Board from time to time to receive for examination, and to recommend for the Society's Agricultural Diploma, Candidates who shall have attained their 21st year, and who shall exhibit the vouchers, and pass an examination on the subjects hereinafter prescribed.

3. That the vouchers to be exhibited shall be such as to afford satisfactory evidence to the board—1st, That the Candidate has attended a farm, and been engaged in the practical operations thereof for a period of two years, or for two separate periods of not less than one year each. 2dly, That the Candidate has attended, for another period of two years, or for separate periods of not less than one year each, the following classes in some seminary recognised by the Board as sufficient:—Agriculture, Chemistry, Natural History, Botany, Veterinary Medicine, and Surgery.

4. That the Candidate's knowledge of practical husbandry, and of the foregoing branches of study, as well as of Technology, Field Engineering and Surveying, Farm Mechanics and Architecture, and Book-keeping, shall be established to the satisfaction of the Board by means of a strict examination.

5. That upon a report made by the Board to the Council on Education, stating that a Candidate has exhibited the vouchers and passed the examination required, the Council shall issue, in favour of such Candidate, a diploma bearing the corporate seal of the Society, and certifying his proficiency in the arts and sciences connected with agriculture.

The Directors avail themselves of this opportunity to express the obligations under which the Society lies to those eminent scientific men and practical farmers who constitute the Board of Examination, and whose valuable and gratuitous services and high reputation cannot fail to enhance the value of the diploma, by affording the best guarantee for the sufficiency of the tests on which alone it is granted.

VETERINARY EDUCATION.—Since the date of the preliminary notice in 1857, the following veterinary students have obtained the Society's diploma certifying their fitness to practise as Veterinary

Surgeons, and qualifying them for employment as such in the public service. In this instance, again, the Society is indebted to the voluntary services of professional men of high standing in conducting these examinations, and they are gratified at being able to report the continued assurances they receive from them as to the efficiency of Professor Dick's establishment:—

April 1858.—John Anderson, Glasgow; James Cairns, Forfarshire; Edward Montgomery, Dublin; R. Laing, Bridge of Weir, Renfrewshire; Hiram Farrell, Bombay; John Mills, Dublin; John Pottie, Renfrew; John Bell, Carlisle; D. Thompson, Fettercairn; W. Connochie, Berwickshire; William Keith, Aberdeenshire; George Stewart, Perth; George Dundas, Wick; George Braime, Yorkshire; J. M. Wilson, Howden; John Edwards, Wales; Henry Pears, Carlisle; David Guthrie, Forfar; Bryce Howitt, Pollockshaws; Joseph Halfey, Southport, Lancashire; William Jack, Edinburgh; Thomas Pratt, Yorkshire; David Gill, Aberdeenshire.

April 1859.—David Fulton, Kirkcudbright; Strettel Scott, Dublin; C. Cunningham, Slateford, Edinburgh; L. Potts, Birch Close, Penrith; John M'Court, Belfast; Thomas Campbell, Mickle Richorn, Kirkcudbright; James Fogan, Scremerston, Northumberland; Robert Mitchell, Carrick Street, Glasgow; Thomas Shea, Dublin; James Blackie, Bellshill, Lanarkshire; John Dunlop, Dreghorn, Ayrshire; William Taylor, Methly, Yorkshire; John Brown, West-Calder, Mid-Lothian; Thomas Taylor, Store Street, Manchester; James N. Haslam, Salford, Manchester; David Paley, Ryhill, Yorkshire; William Rawes, Heldshop, Westmoreland; James Dickie, Edimorton, Ayrshire; Andrew Reid, Cluny Bridge, Fifeshire; Thomas Lambert, Stretford, Manchester; James Bell, Dupplin, Perth; George Scott, Newbridge, Dublin.

MUSEUM.—The Society has on previous occasions been informed that when Government was induced to establish the Industrial Museum of Scotland, the Directors became bound to transfer to that institution the models of implements and the geological collection then forming part of the Museum. The collection was thus narrowed to objects illustrative of vegetable products, and with the view of making it as complete as possible in that department, a contract was entered into with the Messrs Lawson, by which their firm undertook to furnish a collection similar to what had been prepared by them for Government. This has recently been taken off the hands of the contractors and paid for, after an inspection by a committee, who reported in terms of high commendation as to the manner in which the Messrs Lawson had fulfilled their agreement. A few articles have yet to be furnished by them to complete the specification, but much has yet to be done in the way of classification and arrangement. The Society has, at a very considerable expense, obtained handsome and appropriate cases for the lower Hall, but those in the upper are still occupied by the geological specimens, and till these can be accommodated in the Industrial Museum, the collection at George IV. Bridge cannot, from want of space, be put into proper or permanent order. In the mean time the duty of effecting this at the earliest possible opportunity has been devolved on a committee consisting of a certain number of Professors in the University, and of farmers, to whom the objects of the establishment are familiar in their scientific and practical relations.

ESTABLISHMENT FOR 1859.

President.

HIS GRACE THE DUKE OF ATHOLE, K.T.

Vice-Presidents.

EARL OF ABERDEEN, K.G.
EARL OF FIFE.
MARQUIS OF LOTHIAN.
EARL OF WEMYSS AND MARCH.

Extraordinary Directors.

Lieut.-General Lord JAMES HAY.
Sir JOHN OGILVY of Inverquharity, Bart., M.P.
Sir JAMES D. H. ELPHINSTONE of Logie-Elphinstone, Bart., M.P.
ALEXANDER THOMSON of Banchory.
WILLIAM INNES of Raemoir.
The EARL of DALKEITH, M.P.
LORD ELCHO, M.P.
The LORD PROVOST of Edinburgh.
The Right Hon. R. C. NISBET HAMILTON.
Lieut.-General Sir ROBERT HOUSTOUN, K.C.B.

Ordinary Directors.

GEORGE HOPE, Fenton Barns.
HARRY MAXWELL INGLIS of Logan Bank.
WILLIAM FORBES MACKENZIE of Portmore.
ALLAN MACONOCHIE WELWOOD, younger of Garvoch.
ROBERT BALFOUR WARDLAW RAMSAY of Whitehill.
JAMES MACLEAN, Braidwood.
DAVID STEVENSON, C.E., Edinburgh.
F. L. MAITLAND HERIOT of Ramornie.
Sir JAMFS HORN BURNETT of Leys, Bart.
PETER BLACKBURN of Killearn, M.P.
ROBERT SCOTT MONCRIEFF of Fossoway.
Sir JAMES G. BAIRD of Saughtonhall, Bart.
GEORGE HARVEY, Whittingham Mains.
ARTHUR CAMPBELL of Catrine, W.S.
ALEXANDER FORBES IRVINE, younger of Drum.
Sir THOMAS BUCHAN HEPBURN of Smeaton, Bart.
THOMAS SADLER, Norton Mains.
GEORGE CLERK ARBUTHNOT of Mavisbank.
ROBERT STEUART of Carfin.
RICHARD TROTTER of Mortonhall.
GEORGE J. ALLMAN, M.D., Professor of Natural History, University of Edinburgh.
JAMES DOUGLAS, Athelstaneford.
JAMES MELVIN, Bonnington.
JOHN GIBSON, Woolmet.
ARCHD. M'NEILL, P.C.S.
Dr LYON PLAYFAIR, C.B., Professor of Chemistry, University of Edinburgh.
LORD BINNING.
Sir WM. BAILLIE of Polkemmet, Bart.
GEORGE W. HOPE of Luffness.
GEORGE WARRENDER, younger of Lochend.

Office-Bearers.

The Right Hon. Sir GEORGE CLERK of Penicuik, Bart., *Honorary Secretary.*
Sir WILLIAM GIBSON-CRAIG of Riccarton, Bart., *Treasurer.*
JOHN HALL MAXWELL of Dargavel, C.B., *Secretary.*
Rev. JAMES GRANT, D.D., D.C.L., *Chaplain.*
THOMAS ANDERSON, M.D., Prof. of Chemistry in the University of Glasgow, *Chemist.*
ARCHIBALD HORNE, *Auditor of Accounts.*
JAMES STIRLING, C.E., *Consulting Engineer.*
GOURLAY STEELL, A.R.S.A., *Animal Portrait Painter.*
WILLIAM DICK, *Professor of Veterinary Surgery.*
WILLIAM BLACKWOOD & SONS, *Publishers.*
NEILL & COMPANY, *Printers.*
JAMES MACKAY, *Silversmith.*
ALEXANDER KIRKWOOD, *Medalist.*
ALEXANDER SLIGHT, *Curator of Implements and Machines.*

Chairmen of Standing Committees.

Argyll Naval Fund, .	ALEXANDER LAMONT of Knockdow.
Chemistry, . . .	Dr THOMAS ANDERSON.
Cottages, . . .	ROBERT G. BAILLIE of Culterallers.
District Shows, . .	ROBERT MACLACHLAN of Maclachlan.
Finance, . . .	ANTHONY MURRAY of Dollerie.
General Shows, . .	DONALD HORNE, Atholl Crescent.
House and Buildings, .	JAMES ANSTRUTHER, Moray Place.
Machinery, . . .	JOHN MILLER of Leithen.
Museum, . . .	Professor BALFOUR.
Premiums, . . .	Dr LYON PLAYFAIR, C.B.
Publications, . . .	ALEX. FORBES IRVINE, younger of Drum.
Veterinary College, .	Professor GOODSIR.

Monthly Meetings.

The DUKE OF BUCCLEUCH, K.G., *Chairman.*
Sir A. C. GIBSON-MAITLAND, Bart.; The Right Hon. Sir JOHN M'NEILL, G.C.B.; and DAVID MILNE HOME of Wedderburn, *Deputy-Chairmen.*

Council on Education.

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to prescribe a curriculum for Agricultural Education, and to grant Diplomas.

Members of Council named by Charter.

The DUKE OF ATHOLE, *President.*
The Lord Advocate.
The Dean of Faculty.
The Professor of Agriculture.
The Professor of Anatomy.

The LORD JUSTICE-GENERAL, *Vice-President.*
The Professor of Botany.
The Professor of Chemistry.
The Professor of Natural History.
The Professor of Technology.

Members of Council named by Society.

Sir GEORGE CLERK, Bart.
Sir W. GIBSON-CRAIG, Bart.
Sir ALEXANDER C. GIBSON-MAITLAND, Bart.

JOHN FINNIE, Swanston.
JOHN MILLER of Leithen.
ROBERT RUSSELL, Edinburgh.
JOHN WILSON, Edington Mains.

Board of Examiners.

Science and Practice of Agriculture—Mechanics, and Architecture of the Farm—Professor JOHN WILSON; JOHN FINNIE, Swanston; ROBERT RUSSELL, Edinburgh; and JOHN WILSON, Edington Mains.
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Book-Keeping and Accounts—KENNETH MACKENZIE, Accountant, and PETER M'LAGAN, yr. of Pumpherston.

EDINBURGH, 15*th June* 1859.

CONTINUED STATEMENT AS TO THE MODE OF ERECTION AND TENURE OF HOUSES AND ACCOMMODATIONS FOR LABOURERS AND TRADESMEN ON THE ESTATE OF ANNANDALE IN DUMFRIESSHIRE, BELONGING TO J. J. HOPE JOHNSTONE, ESQ., M.P.

By CHARLES STEWART, Hillside, Factor on the Estate.

Note.—In 1844 a communication was received from Mr Stewart of Hillside, and published in vol. i., p. 214, of the new series of the *Transactions*, describing a system which had been adopted so early as 1814 on the Annandale estate, of erecting labourers' cottages. The peculiar features principally consisted in the grant of a lease of the housestead and a large garden, at a rent of 5s. yearly; and in the building of the house at the tenant's own expense, with the exception of the price of timber and any freestone employed, which were provided by the proprietor—the landlord reserving right to resume possession on giving six months' notice, and on paying the proportion of the tenant's outlay according to certain fixed rates. The following paper is a continued report by Mr Stewart, as to the operation of this system up to the present time; and that by which it is succeeded embodies observations on its general results, communicated by the Rev. Mr Hope, of Johnstone and Wamphray Free Church, a gentleman who has given the subject great attention.

IN the *Transactions of the Highland Society for* 1844 will be found a statement on this subject; and as the accommodation of cottars, and rural policy in general, have of late been attracting much more attention than it then did, it has been suggested that the narrative then given should be again published with the observations which occur from fifteen years' additional experience of the extension of the system on the same estate, and its results.

Since 1843 a number of additional houses have been built on the estate, on the same tenure—generally one, and sometimes two in each year. They are almost all in the parish of Johnstone and lower part of Kirkpatrick-Juxta, and it is to this portion of the Annandale estate that the present notice will be confined.

It stretches along the west side of the river Annan for eight or nine miles, and comprehends forty to forty-five farms, mostly arable, or in the course of being improved by cultivation, and in extent from 12,000 to 14,000 acres.

The additional houses built since 1843 have shown progressive improvement. The walls are a little higher, the under floors and lofts all boarded, the room-end occasionally stoothed and papered, and the extra convenience of milk-house and pantry more attended to, and the byre and outhouses at once slated.

It must be admitted, however, there is still too much crowding, with less ventilation, and fewer conveniences than are desirable—often still two beds in the kitchen or living-room, and sometimes two in the room-end; and the garret or loft, though floored, not finished so as to prevent the too great alternation of heat and cold. But as

the children generally leave their paternal home at twelve or fourteen, there is not much occasion to use the garret or loft for sleeping. Judging from the advance that has taken place within the last few years, there is little doubt that the new houses will gradually be improved in their structure and convenience; and as to the old houses, there will be found little difficulty, by adding to the height of the walls by outshots and otherwise, in making them correspond to the taste and habits brought about by a more general knowledge of convenience and comfort, accompanied by a higher social position, which we hope and believe the labouring classes are gradually attaining.

The houses are, in general, placed in single dwellings (not hamlets) along the twenty miles of turnpike roads, and the cross parish roads which intersect this portion of the Annandale estate, or on the boundaries of farms. Of late years, much attention is paid to having the houses placed in situations cheerful and agreeable. They are, with rare exceptions, kept whitewashed, and have a comfortable and cleanly appearance, quite removed from any degree of squalor, which is apt to attach to habitations changing occupiers frequently.

The cost to the tenant, which was then stated at £21 for the smallest house, may be now increased to £30 or £35, from the higher rate of tradesmen's wages, and better finishing. This may be said to be equal to a rent of £2, 5s. to £2, 10s., for the following nineteen years—or if the original cost, as in cases of houses with more internal or external accommodation, is £40, it is equivalent to £3 of rent.

The landlord's cost of freestone and sawing wood for the smallest house is now £12 or £13, and the value of the home timber perhaps £8 or £10—so that with interest, at the end of 19 years, the proprietor has the house at a cost of £45 to £50.

The desire for pendicles and grass for cows has fortunately been greatly on the increase, and this important accommodation is far more general. In almost every case the situation is now fixed so as to admit of from 2 to 5 or 6 acres being given, or a cow's grass in a field, which in several localities are laid out for the purpose at a rent of £3 to £3, 10s. per cow; but the pendicle is preferred. The land being often coarse and uncultivated, the proprietor, besides enclosing it, gives assistance in draining and liming. It is improved till it affords not only summer grazing for the cow, or perhaps two, but in some cases meadow hay, and generally green crop, and corn at a rent (though what it is originally worth as part of a farm is the rate charged) which is comparatively low, being from 10s. to 20s. per acre; and, what is of more consequence, increasing the interests of the cottar, and giving scope to the intelligence, which is so generally possessed, and to the industry of the family, without materially encroaching on the time for earning his

regular money income. Opportunities are at hand to purchase turnips, growing meadow hay, and corn, from farmers who get the dung in exchange. A good supply of milk is secured for the family; and the ready sale of the pork, butter, and perhaps calf or young beast, meet any outlay as well as rent, which it is the habit to pay with perfect promptitude.

The occupiers of the houses, as was stated in 1843, are all Scotch, mostly born on the estate, and are such as constitute the ordinary rural population of parishes separate from villages, being chiefly labourers finding their employment in draining, on roads, in woods, &c.; carpenters, blacksmiths, masons; widows of small farmers and cottars. There is abundance of employment for all, the resident labouring population, indeed, being much under what is, and may be for long, required in the district for draining and other improvements.

Many of the original leases are now expired; but very few changes have occurred. The tenants, or their families, remain under renewed leases, where more outlay is required, or without lease, at rents always intended to be moderate, from 20s. to 40s. according to the house and circumstances of the family. It is only where the family die out, emigrate, or move for some superior employment, that vacancies occur. Where let of new to a stranger, the rent is higher, the house with cow's grass being from £5 to £6.

The number of houses erected on this portion of the Annandale estate, on the conditions referred to, is about 70
Houses erected chiefly at expense of the proprietor, occupied by the same class, ... 40

110

Of these, the occupiers of which have cows on pendicles or on grass fields, there are about 75.

In Johnstone, these occupiers amount to between a third and a fourth of the parochial population, the remainder consisting of farmers, their servants and others, in houses held immediately under them, or those in the direct daily employment of the proprietor in his woods and general establishment.

In 1844 it was observed that here, as on other extensive estates, peculiar facilities are afforded in carrying out this or similar systems, from (generally) the abundance of home timber, saw-mills, &c., at command, and from the power of limiting the erection of habitations so as not to exceed the demand for labour. But though not so extensively, much may be done by many proprietors on the same principle of giving the cottar an interest in and security of his house, by his paying less or more of the original cost, or at least holding under lease direct from the proprietor, and especially by accommodation of pendicles, &c.

We observe, indeed, a few other liberal proprietors who under-

stand and estimate aright the character of our peasantry, adopting the same principle, though on a smaller scale.

The result of the mode adopted as to leases and pendicles has hitherto been very satisfactory to the proprietor Mr Hope Johnstone, and very gratifying, inasmuch as it has been the means of affording permanent residences, with a share in rural interests, to a large class of the native population on his estates, who are attached to their country, and whose general character and worth he greatly appreciates.

The writer of this, as in 1844, has been induced to give publicity to these short details, in the hope that it may at least attract attention, and give rise to suggestions on a subject of such importance to the rural population of Scotland.

He might have enlarged more on the advantages shown to have arisen, but prefers leaving this part of the subject to an onlooker who may be supposed to view them with a more impartial eye. He certainly concurs, however, in all the sentiments expressed in the remarks appended to this, written by a clergyman in the immediate neighbourhood, who by the interest he takes in the people around him, as well as by the great intelligence shown in his discussion on the means of elevating this class of society in general, is peculiarly well qualified to treat this notice with discrimination and judgment.

REMARKS BY THE REV. MR HOPE.

The results of the system of cottage tenure and small holdings described by Mr Stewart are not matter of theory and speculation, but of actual experience—an experience embracing a sufficiently wide district, and extending over a period of nearly fifty years. And we may say at once that these results are most gratifying and satisfactory. What we chiefly value in the system is its marked effect in producing and perpetuating an orderly, respectable, well-conditioned peasantry. The problem which is generally looked upon as so difficult of solution, has here been solved with eminent success. It has been shown to be quite practicable to elevate the labouring man, not only without burdening the farmer or the landlord, but to the manifest benefit of both; to foster small holdings without depressing agriculture or retarding improvement, and to combine permanence with progress. It will, of course, be understood that we are not now dealing either with small farmers, or with mere labourers on the farm—whether cottars holding of the tenant, or hired servants, but with an intermediate order bordering upon both of these classes, and occupying the space between them. In the frequent discussions which are taking place, as to the improvement of the working portion of our rural population, we usually notice only *three* leading orders referred to, as constituting the agricultural community—viz. landowners, farmers, and labourers or farm-servants. It is often lost sight of, that there is

a *fourth* class, having its own distinct place in a well-ordered rural economy, attached to the soil, and taking a higher position than the mere hired labourer, but not having yet advanced to the platform of the small farmer. And it is of all the more importance that this class should be duly recognised, that, from the general adoption of the large-farm system, there now yawns, in many districts, a wide gulf, and we fear, an ever widening one, between the farmer and the labourer. Let us glance at some of the prominent results of the plan of cottage holdings described above by Mr Stewart, the factor for the Annandale estates. And as being the primary object aimed at in the arrangements, and that to which we wish to draw special attention, we notice,

I. *The advantages to the Cottars.*—These are both *moral* and *financial;* but while not disparaging the latter, it is to the former that we attach the greatest value.

1. The principle of granting such leases only to persons of respectable character and orderly conduct, operates as a bounty upon good behaviour, and does much to secure the permanent respectability of the class; while the power of resumption which is retained in the hands of the proprietor, and which it is well known will only be exercised in the case of flagrant misconduct, affords an additional safeguard.

2. The outlay required in erecting the house, implies the previous exercise of industry and frugality, and the prospect of having this expenditure to incur, furnishes a strong incentive to the practice of these virtues. Young men are aware that good conduct on their part will not be overlooked or forgotten, and they are encouraged to cultivate saving habits, which will prove invaluable to them in their future life. And it is always found that the plan of attaching a few acres of ground to the house tends to foster habits of industry and management, both in the man himself, and also in his wife and children. The labour which the cottager expends upon his little holding does not materially interfere with his ordinary occupation, whatever that may be; it is supplementary to, not a substitute for, his usual means of livelihood; a "staff," not a "crutch." And then, no one can fail to see how very different a woman his wife is—with her cow to attend to, her milk for her household, her butter and eggs to take to market, her calf and pig to care for—from what she would have been, had her husband been only a poor labourer, renting the bare walls of a house from a farmer, and removable at every term; how *managing* and thoughtful she becomes, how provident and fertile in resources, how much of the better sort of feeling of importance and self-respect is engendered; she sees how much will now be expected of her, and how much she can really do for the support of the family, and she is put to her mettle to do her best. And the children come at an early age to take part in the lighter labours

connected with the pendicle; they aid in the various kinds of field work as they are able; they lend a hand in feeding and tending the cow, and such like; and in this way they get acquainted as they grow up with processes which they may afterwards have to practise, and are trained to habits which will stand them in good stead when they go out into the world.

3. It is needless to say that the system of cottage tenure and small holdings here advocated, differs in every essential particular from that which has wrought such mischief and wretchedness in Ireland, and is different, or rather opposite in its results. Here there is no grasping class of middlemen—here there is security of possession combined with moderate rent—here regard is had to the character and conduct of the applicant for a lease—and here care is taken that a full supply of labour shall be within reach, and that the population shall not be increased beyond the means of employment—all which elements were absent in the Irish system; so that there is here every motive to diligence, frugality, and good behaviour, and a counteractive provided, instead of a temptation afforded, to indolent and reckless thriftlessness in all the members of the family.

4. It may not be very easy to explain, but every one acquainted with our rural population will understand, how it raises the status of a labouring man, when he becomes the possessor of a cottage built by himself upon a long lease, and still more when he obtains a few acres of land in connection with it. He is now attached to the soil, and has an interest in it, and let mere utilitarians talk as they please, there is something, yea, much, in this, especially to our countrymen north of the Solway, who certainly have the taste and tendency to which Sir Walter Scott gave humorous and pithy expression, when he observed, that "whenever a Scotchman gets his head above water, he invariably *makes for land.*" The cottager is now differently looked upon by his neighbour, he is differently looked upon by himself. He is no longer a waif drifting hither and thither as accident or whim may determine, but a man with a fixed residence of his own, his garden, his field, his cow and calf, his sheep or two, his pig or two, security in his holding, permanency in his neighbourhood; a distinct and recognised member of a settled community. And as the attaining to this position implies good character, so in such a community there is fostered the desire and the effort to maintain the measure of credit and respectability to which they owe their place and privilege. It becomes a point of honour as well as of principle to make good the understood condition of their acquiring and retaining their holding. There is thus generated, not a spirit of rivalry or strife, but a wholesome public opinion, which operates not merely in leading to the keeping of the house and garden in good order, and the improvement of the pendicle, but also in the way of a

stimulus to a creditable style of living, and the general good management of the family. This is one of the influences which cannot be accurately gauged or defined in words, but it is not the less real and operative on that account. One of these cottars being guilty of any disreputable conduct, or suffering his premises to fall into disorder or disrepair, or his land to be ill cultivated, or falling behind in his rent, would feel that he was in a manner *losing caste,* and that his neighbours and those of his own rank and class were "looking down" upon him, and had a right to do so.

5. One of the most distinctive and pleasing features of the system, and productive both of comfort in point of feeling and of solid advantage, is the *security* of possession, both as respects the house and land. Indeed, the happy remark of the late minister of Eskdalemuir regarding the tenure of the Duke of Buccleuch's farms, that "the security is all the charm," is equally applicable to these smaller holdings and this humbler class. There is the utmost confidence felt by the occupants of these cottages that they will end their days in them, that during the currency of the existing leases no power of resumption will ever be exercised; and when they expire, that they will be renewed upon easy terms—in short, that their little holdings will descend like an inheritance from father to son, and that all their plans and arrangements may be formed upon this understanding.

6. One of the palpable advantages resulting from this permanency of residence, in addition to the comfortable feeling of security, is the privilege of having the young continuing from year to year under the same teacher, and both young and old continuing from year to year under the ministrations of the same pastor. Every one knows how much children lose by frequent changes of schools and schoolmasters, and how injurious this proves to the families of a shifting population. Besides, it is found that, partly from this permanency of abode in the same locality, and partly, no doubt, from the more comfortable circumstances of the parents, there spring out of these cottage homes a much larger proportion of men who rise in the world far above their original starting-point than from the floating families referred to, where the children are subjected to frequent changes in the mode of teaching, generally accompanied, in their case, with the additional evil of irregular attendance at school.

And with regard to the other point noticed above, it cannot be doubted that there is a great advantage to a family in remaining for a lengthened period under the pastoral superintendence of a minister who has become intimately acquainted both with parents and children, who takes a deep interest in their welfare, knows their several characters and circumstances, and is enabled to act as the friend and counsellor of all. In like manner we might refer to the effect of this settled residence in producing and strengthening

the genial feelings of neighbourly attachment and friendly sympathy, which either scarcely spring up, or are rudely repressed when there are frequent removals and separations.

7. Of the direct *pecuniary* advantage of this system to the cottars much might be said, though it may not be easy to give the precise figures, as in each case so much depends upon the management of the land and of the cow, &c. But it may be safely affirmed that, in general, the money value of the privilege is considerable. This is proved by the eagerness with which such leases are sought for, and by the general opinion of those who note the various items of produce of the holding in the shape of milk, butter, calf, pig, and such like. It is not unusual to hear from the mother of a large family that "the cow" has greatly helped to "bring up" the children.

8. Finally, where small farms are retained—that is, where, as in this district, there are still a considerable number of farms of one plough, or from 80 to 100 acres, interspersed among the larger—the Annandale system of cottage tenure paves the way and furnishes a stepping-stone to the possession of a farm. The cottar sometimes himself makes this advance in his own day, and in many cases, some member of his family achieves it in the next generation. And we regard it as most important that there should be these points of contact and connection established and maintained between the different classes of society, and that such avenues should be kept open, through which industrious and enterprising men may make their way from the lower to the higher grades of the agricultural community. But while thus incidentally dropping a word in favour of the retention of at least *some* small farms, believing it to be for the true interest both of the country and of the proprietor, we are carefully to observe that the system of leases and small holdings of which we are speaking is quite independent of the existence of small farms, and might be brought into operation and made to fit in where the large-farm system prevails.

II. *Advantages to the Proprietor.*—1. It must be obvious to every one that it is at once a high gratification and a solid benefit to a landowner to have a respectable, sober, well-behaved set of cottagers upon his property; who, having resided there for many years—perhaps for successive generations—have become in every sense attached to the estate; whose welfare he has promoted; whose respect he has secured, and whose trustworthy service he can obtain whenever he requires it. One cannot, of course, put a precise money value upon such a consideration as this; but we are persuaded that few proprietors will deem it to be unsubstantial and delusive. And it would be difficult to point out any mode by which such a desirable state of things may be so certainly and easily attained as by the plan pursued upon the estate of Annandale. It will be far more surely and far more

cheaply secured *thus* than by the expenditure of large sums of money in building cottages for labourers who are drifting about among the farmers from year to year, however important it may be that these latter should be comfortably accommodated.

2. But how stands the case with respect to the *pecuniary* aspect of the matter? Is the landlord required, in this instance, to be liberal and lavish of money in promoting the comfort of the peasantry at a considerable sacrifice to himself, content with the recompense of an approving conscience, the gratitude of the class whom he has benefited, and the applause of the general community? By no means; though, even if it were so, it might not after all be a bad return; and the thing itself might be right and proper to be done, with or without such a recompense. And we are well assured that an ever-increasing number of landowners are so sincerely anxious to promote the comfort of the working-classes that they would not make the adoption of any measure which promised to be beneficial hinge upon the question of expense or remunerative return. But at the same time it is extremely satisfactory to be able to say that the system of cottage leases and small holdings to which we refer does not involve a pecuniary sacrifice to the proprietor, but, on the contrary, is demonstrably profitable.

Under this system, as has been explained, the landlord expends £20, including home timber, in the erection of each cottage, the cottar himself doing all the rest; and when, at the expiry of the lease, the house falls into his hands, he gets possession of it for £45 or £50, including interest and compound interest upon the original outlay—which, taking into account the rent it will then bring, must be considered a good bargain. But, besides this, where a *pendicle* or small holding has been attached—and this has come more and more to be regarded as an essential accompaniment—the ground has, in almost every case, been greatly increased in value by careful cultivation, and a higher, though still very moderate, rent is willingly paid, than would have been received for the land as part of the farm to which it originally belonged. Without entering into minute details, we may confidently affirm that, in the district referred to, the rent drawn from pendicles is at present greater than the land would have otherwise yielded; and that there are, in addition, prospective profits which will gradually accrue as leases expire, and houses and holdings fall into the proprietor's hands, supposing even the rents still kept moderate, as hitherto. But there are other advantages of a pecuniary kind, resulting to the landlord, not less real, though less direct than that just mentioned. One of these is the effect of the system in *keeping in check and reducing the poor-rate*. Of course the chief benefit here is the high moral and social one, resulting to the cottagers themselves, in being kept above the level of pauperism. But with the growing and well-founded dread of an advancing assessment, it will not be deemed

a trifling recommendation of the system under review, that it is extremely rare to find one of this class upon the poor-roll, and that in this way, a permanent supply of labourers may be located upon an estate, without the drawback or the risk of multiplying paupers.

And in this connection we may allude—though we need not do more than allude—to the advantage of possessing a class of labourers who, together with their families, are by the circumstances of their position put upon their good behaviour. Few of those waifs of society, and torment of landlords—poachers and the like—are found, we fancy, among the inmates of these cottage-houses.

III. *Advantages to the general Community.*—Upon these we cannot, at present, afford room to dwell. But really it is not necessary. It is too obvious to require illustration, how much better it is for society at large that the numerous class of labourers should be orderly, moral, and *well-to-do*, than if they were poor, ignorant, and ill-behaved. Among the class of cottagers of which we have been treating, education is universally diffused; intelligence advances apace; habitual regard is had to moral character and social progress; general good order and industry and sobriety widely prevail; and surely all this is good in itself, and good in its influence upon others, and in its effects upon the general community.

Such, then, are some of the beneficial results of the system above described. If we were asked to name any counterbalancing evils which experience has shown to attach to the plan, we must say that we should not well know what to specify. Indeed we are not aware of any social arrangement to which so few objections apply, in which so few drawbacks are to be found, and which produces such general, substantial, and unqualified benefits to all concerned. It is, we think, in every point of view, advantageous to the proprietor—it is in every point of view advantageous to the rest of the community; and, especially, it is in every point of view advantageous to the cottars themselves. It is advantageous as regards its pecuniary results; as regards the standing and credit of the cottagers; as regards their respectability of character and conduct; as regards the spread of intelligence, and the practice of industry and economy among them; as regards the elevation of the tone of morality; and as regards the disposition to try to rise in the world, infused into the young, and the facilities for rising thus afforded. Possibly it might be thought, that under this system too much power is retained in the landlord's hand, and that, in consequence, the class of cottars referred to must be kept in a state of undue subservience to the superior. We believe that there is no real ground for this apprehension. On the contrary, we do not know any portion of the agricultural population, more ready to think for themselves, and to act upon their own convictions, than the holders of these leases. We are fully persuaded, and experience has shown, that they are

just as likely to act an independent part as the class of farmers, whether large or small.

In a word, we look upon this as a most important and valuable portion of a rural community, and we regard the system which fosters it as worthy of careful consideration, and, we venture to add, of extensive adoption. Such a class of people are well worth cherishing. We do not plead that they should be coaxed and coddled. They need nothing of the kind. On fair and reasonable terms, they are able and willing "to do their own turn," as they express it; and it will be found that they render an ample equivalent for any encouragement and assistance that may be afforded to them. The best interests of our country would be promoted by the wide adoption of such a system. The class of people thus formed and perpetuated are among the choicest of our Scottish peasantry. Indeed, it has been affirmed by one who weighs his statements well, and than whom few in any rank of life are better entitled to pronounce an opinion, that the cottars of this class, together with small working farmers, are more thoroughly and distinctively Scotch than any other portion of the population; that in them we have still preserved to us some of the best and most peculiar features of our national character; that, while in many cases the tenant-farmers of considerable capital have been dropping one after another of the old characteristic qualities and habits of Scotchmen, they have been retained in freshness and vigour in such households as those of which we have been speaking; and that, if we would conserve those moral lineaments and practices of old Scotland, "which make her loved at home, revered abroad," we would do well to foster the class of cottars, each of whom dwells in a house built in whole or in part by himself, and, in addition, possesses a small holding to exercise his industry and thrift, and aid in the decent and comfortable support of his family.

We shall only add, that we have reason to believe that the system under review has given entire satisfaction to the extensive proprietor, on whose estate it has been maintained in operation for wellnigh half a century.

ON THE CULTIVATION AND MANAGEMENT OF THE BEAN-CROP.

[This article consists of the addresses at the Monthly Meeting of the Society, on 23d March 1859.]

MR HOPE, Fenton Barns, East Lothian, said:—There are farmers who admire above all things fine wheat in full ear; some again look with delight on the waving of the shining and bearded barley; while others declare that for beauty the silvery oat "bears the bell." Potatoes in well covered drills, with their bright and uniform flowers, have their advocates also; and even turnips, when clean, close, and giving forth the strong smell indicative of rapid growth, are viewed with eagerness and delight by all whose talk is of cattle and of sheep. Certainly these crops have their own peculiar beauty, but part at least of the feeling they excite is often owing to their being the most suitable and profitable in the locality of the beholder. But strong healthy beans in full bloom awakens the admiration of dwellers in both town and country. The odoriferous perfume of the fine large flowers, the grace and beauty of the broad luxuriant foliage, seize the senses of both smell and sight, and render this plant an object of interest to all, independent of its economical value. An examination of the seed when it first begins to germinate, shows as beautiful an illustration of incipient vegetation as can possibly be conceived. It is curious to notice, also, how the pods, when they first begin to set, are filled with a soft downy cotton, which keeps the tender young seeds in their place, and protects them from injury by the shaking of the wind; while as the grains increase in size, approach maturity and harden, this substance disappears, and that in the exact ratio as the necessity for it lessens. On the other hand, the pod of the pea, which is a creeping plant, and does not require the same protection, is not so liberally provided for. The construction and growth of these simple plants strikingly exhibit the infinite wisdom of the great Architect of the universe in the adaptation of means to ends, and the strict economy which pervades all nature.

In the rich and fertile valley of the Nile, beans were cultivated at an early period of human history. They flourished also in the agriculture of the ancient Greeks and Romans; and the Fabii, one of the noblest families of Rome, are said to have derived their name from the connection of their ancestry with the cultivation of the bean. As a specimen of the notions of those days, I may mention that Cornelius Celsus, who wrote a treatise on agriculture as well as medicine, declares against weeding or hoeing beans, because, says he, "after having pulled them up with the hand, a crop of grass remains for hay." Columella, however, had more enlightened ideas, and he justly condemns him for this doctrine.

"It appears," Columella says, "bad husbandry to suffer weeds to grow up with corn, which must deprive the corn of so much nourishment." He adds, with respect to beans, "that the keeping them clean produces much meal and a very thin husk."

It is unknown at what period the cultivation of the bean was introduced into Great Britain. It has been matter of dispute whether the first importation of seed came from Egypt, or from Spain or Portugal. It is generally believed that the Mazagan variety, which has long been esteemed one of the best for an early crop and for garden cultivation, was imported direct from the Portuguese settlement at Mazagan, on the coast of Morocco. However, the bean-crop has long been an important one in this kingdom. Indeed, before the introduction of turnips as a field crop, it was the only one that farmers then possessed for alternating with white or grain crops. It constituted also, in former days, a large portion of the food of the people. Of late years, however, a full supply of the more wholesome and agreeable wheaten bread has been within reach of all classes, and beans are now mainly applied to their legitimate purpose of feeding horses and dairy stock, and fattening cattle and sheep. The extended cultivation of turnip, mangold-wurzel, and broad clovers, which has distinguished the agriculture of late years, has materially trenched on the ground once occupied by the bean. The stimulation given to the growth of the potato by its frequent disease and consequent high price, and also the facility now afforded for its conveyance by railway to the manufacturing districts, has in East Lothian diminished the extent of land under beans fully one-half, within the last twelve years. Potatoes being all sold off the farm, in past times East Lothian farmers looked upon them with anything but favour; but now the command of guano and other portable manures renders this more severe mode of cropping not only consistent, but identical with good farming. However, the agricultural statistics recently obtained, under the auspices of the Highland Society, show that the bean-crop in Scotland still extends to about 40,000 acres imperial measure, of which about one-ninth part, or 4500 acres, pertain to East Lothian. The small county of Clackmannan has the largest number of acres under beans in proportion to the acres under tillage—viz. 7½ per cent. Stirlingshire ranks next, having 5 per cent; then East Lothian, with 4½ per cent; followed by Linlithgowshire, which has nearly 3½ per cent. As might be inferred from this distribution of the crop, beans delight in the rich carse-lands, the deep alluvial clays, and the fine strong loams which distinguish the districts I have named. Strong loams, which are most suitable for wheat, are also, generally speaking, the best for beans; but even fine soft turnip-soils, when in high condition, are found to yield fair crops. Indeed, in all the early districts of Scotland, the bean may be found

profitable in itself, and invaluable in lengthening the rotation and postponing the recurrence of turnips and clover, which are specially liable to disease and failure from frequent repetition. Beans are considered a green or fallow crop, from being usually manured, drilled, horse and hand hoed; but the land is more frequently foul after them than after either potatoes or turnips. This arises from the early period at which they are sown, their method of growth, and also in part from the way they are cultivated. Being a tap-rooted plant, it penetrates deep into the soil, thus mellowing and improving the subsoil; its large and succulent leaves absorb part of their nourishment from the atmosphere, and by their fall and decay tend to enrich the ground on which it has grown. Wheat, or other white grain, is generally more luxuriant after a crop of beans than after either turnips or potatoes, at least when an equal quantity of manure has been applied to them. In the six-course rotation adopted in East Lothian, beans generally succeed oats in the fifth year, there being—1st, turnips; 2d, wheat or barley; 3d, grass; 4th, oats; 5th, beans (or potatoes); 6th, wheat. They are sometimes sown directly after grass, and with great success; but as a rule, oats are the more profitable crop. When grass seeds fail, beans may be substituted with great propriety. On fine soils and under favourable circumstances, beans and wheat have been often known to succeed each other alternately with profit to the farmer for a long series of years.

Though botanists only recognise one species of bean, there is a large number of varieties cultivated by gardeners, and about a dozen other kinds that are grown in fields. It is difficult to say whether there is any real difference betwixt all these latter kinds, as no seed-bearing plant that I am acquainted with changes more by soil and climate than the bean. I have several times got from England beautiful small white beans; but in the course of a few years, the sample appeared quite mixed, fully one half of them being as large as the common Scotch, and having the same darker colour, and I have heard other farmers make the same observation. The variety known as the common Scotch bean is more extensively cultivated in East Lothian, and I believe throughout Scotland, than all the other sorts put together. The best change of seed for us, of Scotch beans, is from the carses of Stirling or Falkirk. Whatever may be said in regard to changing seed of other grains, it is certainly beneficial in the case of beans. One of my neighbours, who succeeds well in raising large crops of fine quality, changes the whole of his seed every year from these places. A variety known as the Pilton or Granton bean, has been rather extensively grown for some years. It is early, and generally allowed to be very prolific. I have grown it for three years, and think highly of it. An English bean gained the premium at Haddington this year, as the best sample of field beans. It was grown by Mr Smith,

Whittingham. He tells me that for several years he has grown part Scotch and part English beans in the same field, and under the same treatment. The Scotch bean ripens eight or ten days earlier, and the straw is better quality, not being so strong or coarse as the other. The English again grows more vigorously, and appears to escape, or suffer less from the attacks of mildew, and a species of aphis that often blackens and impairs the full development of the other. Mr Smith always considered the English to be the best crop, both at harvest time and in the barn. Last year he marked off a certain number of drills of the same length adjoining each other, and stacked and threshed them separately. The produce was, of English beans, $7\frac{7}{8}$ qrs. good, and $\frac{6}{8}$ qrs. grey; of Scotch $7\frac{2}{8}$ qrs. good, and $\frac{6}{8}$ qrs. grey, showing a difference in favour of the English of 5 bushels good. The weight of both was the same—viz. 19 stone 7 lbs. per 4 bushels. The crop was fully 5 qrs. per acre. Altogether, Mr Smith is so satisfied with the English that he does not intend, henceforth, to sow any other. The English produce most straw in bulk, while the Scotch beans, when boiled, burst more freely. My own experience agrees with Mr Smith's, particularly when he says the English variety is less liable to disease than the Scotch. On inferior moorish soil, I have had the Scotch bean die out altogether after it got into bloom, while I had a fair crop of English beans growing alongside of them. Winter beans are not much sown in Scotland. I have grown a few acres several times; but, besides having always plenty to do in autumn, lifting potatoes and turnips and sowing wheat, the land was never so clean after them as the other part of the field under common beans sown in spring, and this was seen more particularly on the removal of the wheat crop which followed after both varieties. However, the quantity and quality of the winter bean were always satisfactory, and coming early into the market they also sold readily.

The period of sowing must depend much on the state of the weather, whether the spring is early or late, and also the condition of the land. My own practice has been to sow as soon after the middle of February as the land became dry enough to be suitable for the purpose, and I have always found the earlier the seed time, the larger the crop of grain, and the finer the quality. However, in some seasons I have seen good crops obtained, even when sown so late as the first week of April, and generally the bulk of straw is greater than when early sown. Though grain crops succeed so well after beans, yet, as their produce is large and highly nutritive, there can be no doubt that they exhaust the land something in the same ratio, even granting that part of their food is what other plants reject. Accordingly, land in rich condition is most favourable for their growth, and they should rarely be grown without a direct application of manure. I have always found that 15 or 16 tons of well-made farmyard dung, applied per imperial

acre, either in autumn, before the land receives the winter furrow, or spread in drills at the time of sowing, is necessary to insure a healthy and full crop. I remember, when a boy, beans were often sown in my neighbourhood without dung. Large portions of them became what was called "rosed;" that is, they stopped growing in height, but sent out numerous small turned-up leaves; as an old ploughman remarked to me, "'they played dirl' in your face." Of course with this disease there was little or no corn on them; but it was simply the want of manure, or the poverty of the land. I have once or twice seen a marked difference in favour of the crop where the drills had been made up in winter, the dung spread in them, and left exposed a couple of months before seed-time, when it was covered up with the seed over the adjoining ridge where the drills were drawn and the dung applied at the time of sowing. In very dry seasons the crop is best when the dung has been applied in autumn; but at other times I have been unable to detect any difference. Artificial manures are sometimes applied to beans; but their effects are not so certain as on some other crops, and the increased produce rarely pays the cost of the application. You can generally discover where guano has been applied by its beneficial effects on the crop; but a mixture of guano, rape-dust, dissolved bones, and sulphate of soda, is more certain to secure a satisfactory result. I can only recommend the use of artificial manures when the land is in very poor condition, or when farmyard manure cannot be obtained. The growth of the bean is much influenced by the state of the weather, particularly by the quantity of moisture it receives. In a wet season there is generally an abundance of straw, but the flowers fall off without setting; while in a dry one, when the straw is only a moderate length, there is frequently a larger crop of grain, and always the finest quality. It is considered highly advantageous to give land a substantial winter furrow previous to sowing beans, as no crop is more dependent on a deep soil. At seed-time it is harrowed down; and if there is any couch or quickens, the grubber should be freely used, and the whole gathered off. Beans should never be sown on foul land. If it is not clean when the seed is sown, it is impossible to clean it afterwards with almost any amount of trouble and expense. The most that can be done is to prevent the quickens from spreading. However desirable it may be to sow early, it is better to delay until even the middle of April than to sow beans on land in foul condition. In East Lothian, beans are almost invariably sown in drills, at intervals of 27 or 28 inches, whether the land is dunged in autumn or in spring. The quantity of seed sown runs about 3 bushels per imperial acre. Some farmers sow a mixture of peas and beans, others grow a few tares amongst the bean crop. A bushel of peas to 3 of beans, and from 2 to 3 pecks of tares to 4 bushels of beans, are the usual proportions. The variety in the straw a mixture gives, is agreeable to the animals that consume it, and sometimes

it improves the return of grain also. But when beans are really a first-rate crop, they yield better without any mixture. For myself, I generally sow about 2 pecks of tares to the imperial acre. The tare-straw is greedily eaten by both horses and sheep; but I have found, from experience, this mixture diminishes the crop to the extent of requiring the tares, which are easily separated, to be sold at one-half more than the beans. This spring I have sold my tares at double the price of beans, and, happening also to have had a larger proportion of them, the mixture has paid well. In dry seasons, like the two last in East Lothian, beans sown in drills at 27 inches apart have scarcely covered the ground at any period of their growth. This made it both difficult and expensive to keep the spaces betwixt free from annual weeds. Even in seasons more favourable, when the straw is ultimately strong and thick, there is always a considerable time during which the horse and hand hoe require to be frequently used to keep the land clean. Horse-hoeing alone will not do it, as, besides being long in closing from the great width of the rows, the seed, from falling some height from the sprouts of the drill to the bottom of the furrow, is to a certain extent scattered, and consequently the braird occupies an irregular breadth of 2 or 3 inches, in which annual weeds are sure to be found. The scufflers or paring-plough, which is sometimes used, leaves also a space untouched beside the rows, which hand-hoeing only can clean. As workers for this purpose are not easily obtained, being at the time when the turnips and potatoes require immediate attention to secure a crop at all, the bean-field is too often left to its fate. As most farmers dislike a crop in this state, I believe it has had a considerable influence in diminishing the culture of the bean; in fact, I have been sometimes very much ashamed at the state of my own bean-stubble with annuals, more particularly two years ago. I had almost resolved to give up their culture on this account, when I had a conversation with Mr Wilson of Edington Mains on the subject, and he told me he had adopted the plan of making his drills much closer than 27 inches, and only just wide enough to have them horse-hoed when young. He had found, by doing so, that, at a much less expense for hoeing, the land was cleaner on the removal of the crop, and the crop itself better. After considering the matter, and studying the accounts of the modes of growing beans in England by dibbling and otherwise, I determined to try the effect of sowing them at different and narrower breadths than the ordinary plan. Last spring I had a broad field of about 40 imperial acres, which had been manured in autumn and then ploughed across, which I intended to make beans, the preceding crop having been oats. Before commencing to sow them the whole field was harrowed, grubbed, and harrowed, until it was quite clean and friable. One-third of the field was then made into drills 27 inches apart and sown in the

ordinary way; another third was sown as it was on the flat with Garrett's drill in 8-inch rows, and the remainder was sown by the same machine at the width of 16 inches. The quantity of seed sown was the same per acre for each lot—viz. rather over 3 bushels per imperial acre, mixed in the proportion of 1 bushel tares to 4 of beans, but which is a larger quantity of tares, by one-fourth of a bushel, than I ever sowed before or recommend for the general run of seasons. The 27-inch drills were harrowed down and rolled, just before the beans began to appear above ground, the other lots being harrowed only at that time. The former were horse-hoed when fairly above ground, and twice afterwards. They were also all carefully hand-hoed once, and a second time along the ends of the drills, and as far up as the workers could conveniently go for the tares. The 8-inch rows came up beautifully, every bean by itself, and about 2 inches from its neighbour; if they had been put in by the hand they could not have been more perfectly done. This lot was not horse-hoed at all, but was run over by hand with the Dutch hoe, and afterwards the people walked over them and pulled out any tall weed that chanced to be left growing in the rows. The drills 16 inches apart also came up well; what struck me most was the rows being so much narrower and more clearly defined than on the 27-inch drills. These 16-inch wide drills were only once hoed by Garrett's horse-hoe; the land being at the time in fine order for its working, not a single weed was left; the hoes having cut close into the side of the rows of beans without doing them any damage. Before harvest the 8-inch rows far overtopped the 27-inch drills, and were also a shade higher than those 16 inches apart; however, they all ripened equally, and were cut at the same time. On the removal of the crop, the ground where the 27-inch drills had been was a mass of weeds, and the whole had to be grubbed twice, repeatedly harrowed, and the stuff gathered off, before it could be ploughed and sown with wheat. With the exception of a small gravelly knowe in the middle of the 8-inch lot, where the drought completely checked the growth of the crop, not a green speck was to be seen either on it or the 16-inch drills. In order to test the yield of the different lots, care was taken when reaping the crop to cut off adjoining portions of equal size, which were afterwards stacked and thrashed separately, and the produce ascertained. The 8-inch drills, being in the centre of the field, were tried against both of the others. It was found that the 16-inch drills exceeded the 8-inch drills by 3 bushels per imperial acre, but the 8 inches exceeded the 27-inch drills by 4 bushels. It might be inferred from this that the 16 inches beat the 27 inches by 7 bushels, but I would not like to make the difference so great, as I found the crop at 8 inches better by 4 bushels an acre on the side next the 16 inches than it was adjoining the 27 inches, though I should say the land was rather the best where the 27-inch drills were. The weight of straw was considerably in favour of the 8-inch drills, as

I weighed it; it was at least a fifteenth part more than that of the 27-inch drills, but the threshing of the whole was finished before I discovered I had omitted to keep the chaff separate, which would have made the difference more considerable. The expense of sowing and cleaning the lots (the other items being the same for all) I estimate as follows:—

1. *The 16-inch Drills.*

	S.	D.
Sowing per imperial acre, ...	1	2
Horse-hoeing, ...	1	2
Total,	2	4

2. *The 8-inch Drills.*

	S	D.
Sowing, ...	1	2
Hand-hoeing and weeding, . . .	3	6
Total,	4	8

3. *The 27-inch Drills.*

	S.	D.
Drawing drills and covering, . .	4	0
Sowing, ...	0	4
Rolling, ...	0	6
Hoeing, ...	3	8
Horse-hoeing 3 times at 1s. 2d., . .	3	6
Total,	12	0

Besides, the expense of grubbing, harrowing, and gathering the weeds from the latter before sowing the wheat after them, cost fully 8s. an acre, and it was not so clean-looking at last as the other lots that required no outlay. But if the manure is applied in spring, when the crop is sown, the land will require a furrow for narrow drills, which would tend to equalise the expense.

The bean grows to the height of betwixt 3 and 4 feet, or more, with a strong upright stem. It has rather a heavy top of leaves, and leaves and the pods also spring from its side, making its breadth some 7 or 8 inches. Assuming, as I do, that drilling is absolutely necessary for the admission of air for the setting of the pods and for keeping the crop clean, in its early stages, it appears to me that rows 27 inches apart are much too wide for a plant of this description; at that distance the plants necessary to cover the ground are overcrowded in the row; thus they often become weakened, and fall to the side. Lord Kames, upwards of 60 years ago, said he "could not recommend the horse-hoeing of beans with the intervals commonly allotted for turnip," but he "warmly recommended the drilling them at the distance of 10 or 12 inches, and keeping the intervals clean of weeds by hand-

hoeing." He adds, "This is an expensive operation, and hands are not always to be got." I grant that 27-inch drills, and horse-hoeing them, is far superior farming to the broadcast method. But we have now drilling-machines that may be pronounced perfect, and horse-hoes such as were not dreamed of in the days of Lord Kames; it is, therefore, in our power to adopt what appears to me a mode of cultivation more suitable to the natural growth of the plant. I may add, that this year I have drilled all my bean-crop, in extent upwards of 50 acres, at 16 inches apart, and it will afford me gratification to show them to any member of the Society, at any period of their growth.

When beans approach maturity, the leaves are generally more or less decayed, but the best test of their being ready for the sickle is the change of colour in the eye, and the readiness with which the bean separates from the pod. Sometimes a part of the pods are fully ripe when another is only forming. In that case, if the season is early, reaping should be delayed as long as the ripe pods will permit; but it must be remembered that the earliest beans are always the finest, and should not be lost for what at best is an uncertain increase. Beans, when cut, are laid in handfuls across the drills for a few days previous to being gathered and bound up in sheaves. Unless when very ripe before being cut, they mould and spoil if tied up at once; but after the foliage becomes withered, if the weather is wet or showery, the sooner they are taken from the ground and set upright the better. I prefer placing only two sheaves together and setting them firmly, one leaning from the east, the other from the west, as being the ordinary direction of our currents of wind. I find they stand thus, as well as four sheaves do when placed in a stook, and that they dry more quickly. To stack beans where either pods or straw is a little green, invariably blackens the seed if there is the least dew or moisture on them; but if perfectly dry they may, notwithstanding a little remaining colour, be secured with impunity. Bean-straw, when successfully harvested, is highly nutritious for stock of all kinds; but when it has been exposed to much rain it is unsafe for horses, from the quantity of sand liable to adhere to it; still it is excellent for litter, and forms an important addition to the manure-heap. The grain is invaluable for feeding horses, and for fattening cattle and sheep. When ground into meal, mixed with cut straw or chaff, and steeped in water for twelve hours, it is fully equal to the best linseed-cake, weight for weight, in cattle-feeding. But it is often possible to sell beans and buy linseed-cake with a profit. For the last two years beans have been fully as dear per quarter as wheat, and sometimes even higher, though I have seen them for years together selling at one-half the price of wheat. In the Haddington market, on Friday the 11th curt., the top price of wheat was 44s. per qr., while beans was 45s.; and the average price of wheat was 41s. 10d., and beans 41s. 3d.

Under these circumstances, I sell my beans, or part of them, and buy cake. My bean-crop this season has paid me handsomely, and in part at least I am indebted to the suggestion of my friend Mr Wilson, to which I have already alluded. Mr Wilson has done much service in many ways to agriculture generally. In this I have derived from him a large and tangible benefit, and I take this opportunity of publicly tendering him my best and most hearty thanks.

Mr PATTERSON, Offers, Stirlingshire, said:—In making a few observations on the cultivation and management of beans, I shall confine my remarks chiefly to a statement of the practice prevailing in the district with which I am best acquainted—the Carse of Stirling—in which district the bean-crop holds a very important place in the economy of the farm.

The land is cropped generally under a six-course shift—viz. first, summer fallow or turnip; second, wheat; third, beans; fourth, barley, with grass-seeds; fifth, grass; sixth, oats; consequently about a sixth part of the whole land is under beans. In some cases the oat crop is followed by beans, or beans mixed with oats, by which the relative proportion of beans would be increased, but this increase is so far counterbalanced by two successive crops of grass in other cases: the proportion above stated is, therefore, pretty nearly correct.

The kind of bean sown is the old Scotch bean, a variety of the horse bean. Tick beans have been tried—though not for several years—but they never succeeded well, the crop being small and the grain of very inferior quality. On the harder kinds of clay, where there is no danger of the crop running too much to straw, a small proportion of peas is mixed with the beans, which, in dry seasons especially, very considerably increases the yield. A small quantity of vetches is very often sown with beans. These are easily separated after thrashing, and are very profitable; there is some danger, however, in seasons favourable to their growth, of their becoming too luxuriant and overtopping the beans, and preventing them from podding. The quantity of seed varies from five to seven bushels per Scotch acre, according to the quality and condition of the land.

In speaking of the preparation of the land for beans, it may be necessary to state that the successful cultivation of beans, as well as of the other crops of the rotation, depends, to a great extent, on the proper treatment of the land when fallow or under turnip. A full crop of beans cannot be expected, unless the land be deeply wrought and well cleaned; but as this cannot be properly done in carse land under a crop of beans, it is of the more importance that it should be done previously. A liberal dressing of lime to the land when fallow has a very good effect on the yield of the bean crop—more, I think, than on any other grain which we cultivate.

In the end of autumn, after the removal of the wheat crop, farm-yard manure is carted out to the wheat-stubble, and spread immediately. On land which has been bare-fallowed, and to which no dung has been applied previous to the wheat, dung is put at the rate of from 25 to 30 tons per Scotch acre; but where the land has been fully manured for turnip previous to the wheat, about two-thirds of the above quantity is now given. By far the most prevalent method is to allow the manure, so spread, to lie on the surface all winter, and in spring to sow the beans, and plough them in with a slight furrow; or plough the land first and harrow in the seed.

Another plan is to plough in the manure immediately after it has been carted out, then in spring to harrow the ground and sow the seed with a drill—or plough with a light furrow and deposit the seed in every furrow with a small sowing-machine or bean-barrow.

Of the comparative merits of these two modes of treatment, as Sir Roger de Coverley says, much might be said on both sides. At first sight it would seem a ruinous waste of manure to leave it exposed on the surface of the ground to be washed and bleached by the rain and wind and frost and snow of winter; but although there is a waste of some of the properties of the manure by this exposure, it is now allowed by scientific men that it imbibes from the atmosphere a considerable amount of valuable food for plants, besides affording a certain degree of protection to the soil from the severity of winter. However this may be, one thing is certain, that in practice this method is found to answer very well, particularly towards the west end of the district, where there is a greater rainfall in the winter and early spring than to the east of Stirling.

I am not in a position to state the result of a continued series of experiments on this point, but a few years ago I tried the two modes before-mentioned, side by side, with the view of testing their comparative merits. The land had been fallowed and limed previous to the wheat crop. After the wheat it was dunged at the rate of 28 tons per Scotch acre. One portion was ploughed in autumn, and in spring harrowed, and the beans sown with a drill. On the other portion, the manure was left spread on the surface all winter; in spring, the land was ploughed and the seed harrowed in. The result was that the portion which was not ploughed till spring produced, per Scotch acre, 8 bushels more beans, and a larger quantity of straw, than the portion ploughed in autumn. The succeeding crops, however, were about equal.

It will be observed that in this instance the land was summer fallowed previous to wheat; had it been in turnip, I think the result would not have been so decidedly in favour of spring ploughing; and as the system of fallowing is rapidly giving way to green cropping, I am of opinion that autumn ploughing for beans will also gain ground.

The application of the lighter manures, such as guano, sulphate

of soda, superphosphates, &c., to this crop, has been tried only to a very limited extent, and, so far as I know, with no very favourable results. Most farmers prefer using them as auxiliaries in manuring their turnip, and reserving a full quantity of farmyard manure for their beans.

The best time for sowing is from the middle of February to the middle of March; but it is better to defer sowing for a fortnight later, than to sow with the land wet.

In the Carse of Stirling, the most generally adopted mode of sowing is broadcast, by first ploughing the land about six inches deep, and sowing and harrowing in; or by sowing on the surface and ploughing in the seed about three inches deep. In seasons when there has been much frost, and the land is very friable, the latter plan does very well.

A third method is, sowing in rows about ten inches apart, by a drill; after harrowing; or ploughing them in depositing the seed in furrow with a bean-barrow. On land infested with annual weeds, this is preferable to broadcast, because it admits of hand-hoeing between the rows, which, if done at the proper time, and before the beans are too far advanced, destroys the weeds without injuring the crop.

Sometimes when land is foul with root weeds, an attempt is made to clean it when under this crop, by drilling from 22 to 27 inches wide, and afterwards grubbing and horse-hoeing; but in heavy clay-land I have never seen it succeed, and in such soils it seems to me very difficult, if not impracticable, to clean land, and at the same time to have a full crop of beans. In one case to which my attention was specially directed, where this kind of drilling was tried alongside of broadcast, when the crop was taken off the drilled land was at best no cleaner than that broadcasted, and had not that mellow appearance which indicates a good state of preparation for the subsequent crop. The yield of beans in both cases was stated to be about equal.

The proper time for cutting beans is when the leaves assume a dark-brown colour, and begin to fall off; the pods becoming yellow, and some of the lower ones black, or nearly so. The common practice in reaping beans is to cut them with the hook; and as the pods are very low on the stalk, they require to be cut very close to the ground. After being cut, they are left lying for a few days before being bound and stooked.

Reaping-machines have been, to some extent, introduced into the district, and on no crop are they used more advantageously than on beans, both in reducing the expense of harvesting, and in saving a good deal of waste incident to reaping with the hook. The grain also stands up better in the stook, and is more easily won. The expense of reaping a full average crop with the hook, including binding, stooking, and gathering, is from 12s. to 14s. per

Scotch acre; by the reaping-machine it can be done for little more than the half of that sum.

This crop is more uncertain in productiveness than any other grain crop we sow, the produce varying from 2 to 7 qrs. per acre; but taking the statistical returns as the ground-work for estimating the value of the crop, it may be stated at about £7 per acre for the grain.

The straw, when well got, is very valuable fodder, and for six months in the year it is the staple fodder of farm horses in the Carse of Stirling; but if in the least degree damped or damaged by heating or mould, it is very dangerous food for horses, and after a bad harvest it is no infrequent thing to have a good deal of disease among them from this cause. In such cases it should be used very sparingly, and mixed with other straw. A good average crop will produce from 1 to 1½ tons of straw per acre; the value being about two-thirds of that of hay.

Beans rank high as an ameliorating preparation for subsequent crops of cereals of every kind, particularly those sown in spring. In the district to which I refer, beans are almost universally followed by barley. This seems to suit very well, the barley thriving fully as well after beans as after turnip or any other green crop. Clover is not now such a sure crop in the Carse as formerly, and one reason assigned for the fact is, its coming so close in the rotation after beans. Various attempts have been made to remedy this by making a change in the rotation, but they have never succeeded; none of the rotations tried having been, in their results, in all respects so satisfactory as the present one.

Mr WILSON, Edington Mains, Berwickshire, said:—After the statements which have been addressed to the meeting, by experienced cultivators from two of the most important bean-growing districts in Scotland, it seems almost superfluous to call a witness from Berwickshire, where this crop never occupied a prominent place, and where it has been gradually restricted within narrower limits in proportion to the opportunity which the command of bone-dust and other portable manures has given for the more extensive cultivation of the turnip. I shall not weary the audience by a repetition of details to which they have already listened, but shall restrict myself to the discussion of a single question in bean-culture—viz. at what distance should the rows of plants stand from each other? Until a comparatively recent period, I had followed the approved practice by sowing my beans in rows 27 inches apart. Several years ago, however, I happened to have a conversation on this subject with a Northumbrian neighbour, Mr Smith of Loanend, who told me that, by sowing in rows about 15 inches apart, he found that he obtained from 4 to 6 more bushels per acre than when he made the rows about double that width.

Acting upon his suggestion, I had adjoining portions of bean-crop, in the two following years, sown one in narrow rows, and the other in wide ones. The latter were ploughed and horse-hoed betwixt the rows, as well as hand-hoed; the former were twice hand-hoed only. I found on both these occasions, as I had been led to expect, that the narrow-rowed portions of the crop yielded the largest produce. But I found also what pleased me exceedingly (and all the more that I had not expected it), that the land on which the narrow-rowed portion of the crop had grown was decidedly cleaner than that which had borne the wide-rowed portion; although they were alike in this respect at the time of sowing, and although the latter had received considerably more hoeing, and that too of a more costly and effective kind, than the former. This unexpected and apparently anomalous result led me to investigate the matter more closely than I had previously done; and I shall now endeavour to state what appears to me to be the rationale of it. When drills 27 inches wide are adopted, a most effective process of combined horse and hand hoeing can be carried out, up to the time when the beans come into bloom. At that stage, however, a regard to the safety of the crop—not to mention the expediency of concentrating the whole labour-power of the farm upon its other green crops—demands that hoeing operations among the beans should then cease, although it by no means follows that their is no further need for them. From three to four months have still to elapse ere the crop arrives at maturity; and unless the spring has been peculiarly genial the beans do not attain in time—perhaps never attain at all—to such a bulk, and closeness of cover, as effectually to preclude the further growth of weeds. But by drilling at 15 inches apart, the crop can get the benefit of hoeing as long as it needs it; for it soon so closes in as to be in a condition to defend itself effectually against both drought and weeds. On the first occasion of my trying this latter mode of sowing, the spring happened to be cold and parching, and I observed, after the bean plants had attained to a height of 9 or 10 inches, that those in the narrow rows began to shoot up at a much more rapid rate than the others which stood wider apart. The advantage gained by the plants in the narrow rows at this early stage of their growth was maintained throughout the season; and accordingly it was found at reaping-time, that this portion of the crop was decidedly taller and bulkier than the wide-rowed portion growing alongside of it. This quicker start and taller growth were, I believe, the causes of that superior yield in grain, and cleaner state of the land, to which I have already referred. I have repeated this experiment sufficiently often to remove from my own mind all suspicion of these results being due to any other cause than to this mere difference in the mode of sowing. But besides this personal experience I have from time to time, as

opportunity occurred, interrogated others who have tried both methods, and have hitherto met with no instance in which the results were at variance with my own experience. I am aware that the conclusions to which I have come on this point are opposed to the opinions of approved agricultural writers, and to the practice of many of our best farmers. So much is this the case that it is sometimes stipulated in the letting of farms, that beans shall be grown only on condition of their being sown in drills not less than 27 inches wide, and duly horse and hand hoed. The theory of course is, that without wide rows there can be no horse-hoeing; and that without horse-hoeing, land under a bean crop cannot be kept clean. Without insisting further upon that actual experience to the contrary which I have narrated, I may be allowed to suggest, that in this matter we have all been influenced (more so perhaps than we were aware of) by what we know to hold good in the case of other drilled green crops, particularly in the case of the turnip, and have too readily come to the conclusion that what is certainly good in the one case must needs be so in the other. But the actual conditions of these two crops are those of contrast rather than of agreement. The bean is sown in early spring; it is erect in its habit of growth; and hoeing operations, in its case, must cease by June. The turnip is not sown until May or June; the tillage operations in preparation for, and subsequent to, its sowing, extend over the whole spring and summer seasons; and its broad and spreading leaves enable it, by the time that the final ploughing is given, completely to overshadow even the large space usually allowed to each plant. Conditions so dissimilar as these are, do certainly warrant the inference that a mode of culture suited to the one crop may not necessarily be the best for the other.

Another theory not unfrequently propounded with reference to the bean crop is, that wide rows, by giving free access to light and air, conduce to its greater fruitfulness. This, no doubt, sounds plausibly enough, and yet I am persuaded of its utter unsoundness. In looking back over the past thirty years, I know that the best crop of beans which I ever had was also the tallest—and it was very tall, the average height of the stems being close upon 6 feet. Being at that time possessed by the theory to which I have just referred, I can still remember how the pleasure with which I looked at this luxuriant crop of beans was marred by a suspicion that it was too bulky to yield well, and that it was only as it approached to maturity that I became convinced of the groundlessness of my fears. There are, no doubt, seasons in which the bean makes a fresh growth late in the season, which adds nothing to its produce in grain, and has the injurious effect of retarding its ripening. But in my own experience I have never seen the bean crop too tall when the blooms first appear, and so I have

come to the conclusion that the superiority of narrow over wide drilling, as regards productiveness, is probably due to the more rapid spring-growth which it usually insures.*

REPORT ON FINGER-AND-TOE.

By James Sanderson, Meigle, Selkirkshire.

[Premium—The Gold Medal.]

There is no department of agriculture upon which the Scottish farmer expends so much capital, or to which he devotes so much attention, as that of turnip cultivation. Nor is this at all wonderful when we consider the inestimable importance of the turnip crop. Adapted to Scotland's moist and variable climate, to her light and porous soil, and suited to her undulating valleys, as well as her elevated slopes, it deservedly occupies the foremost place in Scottish husbandry, and its successful cultivation may be regarded as the basis of successful farming. The turnip crop has enabled the farmer, indeed, to cultivate the mountain-tops as well as the valleys, and but for it, the thousands of acres which have been recently reclaimed would have been still covered with their native verdure. When winter denudes our hills of their greenness, and renders them so bare and barren that they cannot afford sufficient sustenance for our flocks, turnips are the chief substitute, as their nutritive qualities are equalled by no other root. They are the chief food, too, that fatten the thousands of cattle and sheep that are weekly slaughtered for the support of man. Nor is the turnip crop invaluable only as food. It is an essential crop in a rotation to preserve or increase the fertility of the soil by its remains, and therefore provides manure for, and, if properly cultivated, insures the productiveness of succeeding crops. It is, therefore, not at all surprising that the progress of this crop, designed for such important ends, is watched by the farmer with peculiar care.

Like other root as well as cereal plants, the turnip is liable to disease, and the farmer has frequently to mourn over its destruc-

* The conversation with myself to which Mr Hope refers having quite escaped my memory, and no further communication having passed betwixt us on the subject of bean-growing until the day when these papers were read, I had quite reckoned on finding my opinion on this point, of the proper width of rows, at variance with that of the other parties who were to address the meeting. It is therefore peculiarly gratifying to me to find this opinion explicitly corroborated by Mr Hope, and virtually so by Mr Patterson; for after describing several modes of culture which are practised in Stirlingshire, he expressly states that the best results are obtained by sowing broadcast. Our several experience, then, concurs in this, that each obtains the best results with a close-standing crop, although Mr Patterson gets at it by broadcast sowing, while Mr Hope and I, for obvious reasons, do so by close-drilling.—J. W.

tion, from internal maladies or external injuries. So soon as the young plant unfolds its leaves, the destroying turnip-flea (*haltica nemorum*) frequently eats them away, and leaves no trace of the plant. At a more advanced stage, the wireworm cuts through its roots, and it soon withers and dies. Mildew in dry seasons prematurely checks its growth, and frosts often convert it into a watery pulp. Some of these evils, however, may be greatly mitigated, if not altogether prevented, and one and all of them must yield to finger-and-toe, either in regard to the breadth or severity of its ravages. The writer could name several districts where, in some seasons, two-thirds of the crop were destroyed; and it is somewhat remarkable that, until very recently, neither practice nor science have endeavoured, by their researches, to prevent or abate the ravages of so destructive a malady.

Before entering on the subject, it is necessary that I should state in what form finger-and-toe is developed, as it has been maintained, by able writers in an English journal (See *Gardener's Chronicle*, 1855) to be a disease altogether different from that which it is understood to be in Scotland, where it has been known for upwards of fifty years. It has been described by the writers referred to, as a "branched or digitate form of growth, the branches gradually lessening downwards." It is an error, however, to designate a form of a turnip, which corresponds with this description, finger-and-toe. There are few fields in which specimens of this erroneously termed disease could not be found, but the writer never witnessed a crop that was greatly deteriorated by it. It is simply an indication of degeneracy of the plant, or, in other words, a tendency of the plant to revert from its cultivated to its natural state. It is often induced by imperfect cultivation, by deficient manuring, or a sudden check in the early stage of the plant may develop it. Under this form the turnip rarely attains to its proper size, and seed preserved from it only produces more degenerate plants. The turnip, however, is as nutritive as the finest developed bulb, for although it is without form or symmetry, yet no part of its deformity is diseased.

Finger-and-toe, or Anbury—which are but different names for the same disease—is quite distinct from, and inflicts more serious ravages than the mere structural deformity we have just noticed. It is easily distinguished by the formation of excrescences or tumours on the root or rootlets of the plant, which impede the free circulation of its juices, prevent the bulb from enlarging, and often render it a putrid fluid. These tubercles form very rapidly, and some of them become larger than a hen's egg. To the unassisted eye, while they are being formed, they do not seem to differ in texture, either internally or externally, from the sound portion of the turnip; but on carefully examining them, the cells are broken and detached, the cuticle thick, dry, and inflexible, and they ex-

hale an offensive odour. At a more advanced stage of the disease, minute black spots become visible in the interior of the excrescence, which are surrounded by matter of a deep yellow colour, which spreads over the tumour in a somewhat reticulated form, and gradually slides into a lighter shade as it recedes from these spots; the yellow parts soon become black, the tumour rends, and in most cases tumour as well as bulb are eventually either destroyed by insects or changed into a watery pulp. A more minute description of the disease will, however, be given further on.

For the sake of distinctness, I shall discuss respectively the cause of the disease, the different forms of the disease, and the best preventive or remedy for the disease.

In treating of the first of these topics—viz. the cause of the disease, I shall first consider the question negatively, and I remark that "Finger-and-Toe," or Anbury, is not produced by—

1. *The too frequent recurrence of Turnips on the same soil.*—If a turnip crop leaves the soil on which it grows reduced of those ingredients essential for its proper development, it might be reasonably affirmed that the oftener the crop is repeated, it will become more liable to disease. The premises are, however, erroneous; for turnips, as is well known, from the manure that is applied to them, as well as from the nourishment they derive from the atmosphere, leave the soil richer in all vegetable ingredients. It may be advanced, too, that if the disease is developed, even in the mildest form, in *one* crop of turnips, it will be reproduced in a more virulent form every succeeding crop. With this averment I entirely concur, provided no counteracting agent is applied; but this is the effect merely of pre-existing disease, and not the result of too frequent cropping. Here practice corroborates theory, as I have seen turnips in a garden on the same soil for several years continuously, and the last crop was as untainted as the first; and the fact, too, that turnips are sometimes diseased upon soils where turnips never grew before, leaves not the slightest evidence in support of the idea entertained by many, that the too frequent recurrence of the turnip crop is the cause of "finger-and-toe."

2. *Poor Soils.*—By poor soils I mean those soils which are so deficient in vegetable matter that they do not furnish sufficient food for cultivated crops. There are other soils which, although rich in vegetable matter, yet may be properly characterised as poor, such as soils newly reclaimed, where, from the want of stimulating or decomposing agents being applied to them, their rich ingredients remain dormant, and therefore not available as food for plants. Now it is evident that soils belonging to either of these classes will, in some degree, influence the disease; for vegetable, like animal life, suffers more severely, and falls more rapidly under disease, when not sufficiently nourished. Although these soils, however, which we have designated poor, influence, they by no means generate

"finger-and-toe," for I have frequently observed fields in the poorest condition produce a sound crop, while, on the other hand, I have as frequently observed diseased turnips growing on rich soils. To prove whether the disease is caused by the absence of nutritive elements in the soil, I took a small quantity of soil of rather poor condition, on which diseased turnips were growing, and spread it to the depth of only half an inch over a rich garden soil. I sowed turnip seeds upon it, and covered them so lightly as merely to hide them from view. From the small portion of upper soil, the seeds would no sooner germinate than they struck their roots into the rich soil, from which the plants would receive sufficient nourishment. The disease, however, attacked the young plants only a month after their cotyledon leaves were unfolded, and completely destroyed them ere the bulb was properly formed. Contiguous to this experimental plot of ground, there was not the slightest trace of disease in the turnips which the natural soil produced.

3. *Injurious Substances in the Soil*—We have seen that the disease is developed on rich as well as poor soils. From the analysis of soil which produced diseased, and that which produced sound turnips (by Dr Anderson, as recorded in the Highland Society's Transactions for 1853), it is evident that the disease is not produced by any peculiarity in the chemical composition of the soil. It is, however, somewhat anomalous that we often see two fields, containing soils similar in nature and quality, and, indeed, in every respect identical, yet the produce of one field is diseased and that of the other sound. From this fact, may we not infer that there are deleterious substances to vegetation in the soil of one of the fields, which the chemist cannot detect? The appearance of the disease, however, does not warrant this inference, for if the disease were caused by adverse substances in the soil, the turnips on such a soil would not only be all diseased, but the disease would assume the same form in different turnips. It is not so, however. Two turnips grow contiguously, the one is diseased, the other sound; the tap root only of one is diseased, the lateral roots only of another are tuberous; so that although the tap root and rootlets of the same turnip derive food from the same soil, yet they are sometimes neither all nor alike diseased. We have frequently indeed seen the main root and rootlets, which are the principal organs of nutrition, perfectly sound, while the presence of the disease was only manifested by a tubercle on a tiny fibre, or swelling out from the side of the bulb.

I might notice other circumstances which have been alleged to cause the disease, such as diseased seed, too early sowing and too late thinning, &c.; but as these have obviously not the slightest connection with the disease, I pass on to consider the direct causes of the disease.

On minutely examining and carefully cutting open the ex-

crescences, it is obvious that they are caused by insect life, while yet the excrescences are sound as the roots whence they spring. Larvæ are frequently found in their interior. I have discovered in a protuberance, scarcely visible to the naked eye, upon a young plant only three weeks brairded, a larva, rolled together in its cell as if newly hatched, and before it commenced to prey upon the turnip. From the colour of the young larvæ being exactly the same as the excrescences in which they are encased, they are not easily seen, and but for their black, retractile head, would seldom be observed. At a more advanced stage the larvæ change to a dingy white. The pupæ are of a somewhat tawny colour. I regret that, after repeated attempts to secure the insect in its perfect state, I have hitherto failed, probably from keeping the pupæ either in too high or in too low a temperature, to preserve their vitality. The galls may be produced by different insects, but it is evidently the larvæ of the same insect that I have discovered in them. I have never found pupæ in the excrescences, but invariably in the soil at the root of the diseased turnip,—hence I infer that the larvæ, after feeding upon the turnip, bury in the soil to pass through the pupa stage. The pupæ of different species of insects are no doubt discovered, when the turnip has become putrescent, such as those of the rose and click beetles, &c.; but these have as little effect in producing the disease as the maggots of the carrion-beetle have in taking the life of the animals upon whose carcases they feed. From the galls being formed, as we have seen, so soon as the larvæ are hatched, it is obvious that they are caused by the deposition of the ova, and not by the larvæ eroding the bulb. There are many excrescences that I have examined, in which I could discover no larva, and in which probably no larvæ existed; but I believe the insect inserts a poisonous fluid into the turnip, which obstructs the chief organs of nutrition, arrests the circulation of the nutritive fluids, and therefore deformity ensues, and the plant becomes putrid and dies. A similar effect is produced by the hawthorn gall; for not only does the gall arrest the circulation of the sap, but as soon as it is formed the part of the branch which extends beyond it decays and dies.

The different forms of the disease are caused by the attack of insects on different parts of the plant, and at different stages of its growth. It would be vain to attempt to describe all the different forms of the diseased turnip, as these assume almost every conceivable shape,—now its rootlets shoot away into bead-like appendages, and again root as well as rootlets are enveloped in most unshapely tumours.

The following may be regarded as marked types of the different forms of the disease.

1st, When the young plant has been about three weeks brairded, a slight and regular protuberance forms around the root, about an

inch below the leaves, the central axis is black, hard, and brittle, the leaves soon fade, and the plant in a few days dies.

2d, If the protuberance is irregular, or issues from one side of the root only, and the central axis untouched, the bulb is allowed to form, and the protuberance is carried to its lowest extremity; and if no other galls are formed, the turnip may attain to its ordinary size.

3d, The tap or centre root in a cluster of galls, and the lateral roots sound. This occurs after the bulb is assuming its round shape. Deprived of its principal medium of nourishment, it instinctively, as it were, throws out lateral roots for fresh support, and if these escape the attacks of insects, the turnip may, under this form, also attain to a considerable size.

4th, The centre root untouched, and the rootlets terminating in bead-like galls. Under this form the size of the turnip is not affected, but its substance is dried, and less nutritive.

5th, A mass or congeries of galls, issuing from the under extremity of the bulb, and enveloping as well as depriving root and rootlets of their functions. This may be regarded as the worst form of the disease, for after the turnip is half grown, and its leaves fully expanded, the unshapely excrescence gives way at the root of the bulb, and the turnip, as if pulled and rooted, is separated from the soil.

6th, Wartlike excrescences on the side of the bulb. These injure the turnip more or less, according to their size and formation. If the excrescence has a smooth surface, it is only the portion of the bulb around the excrescence that is not nutritive. When the excrescence is indented or corrugated, rain is lodged in the bulb, and it becomes a mass of decomposing matter. Under this form of the disease the nutritive organs of the turnip are not obstructed.

It is undoubtedly, as I have already said, insect life that produces these different forms. Dr Anderson says in his valuable report on finger-and-toe, in reference to the opinion that the disease is due to insect life, "that it derives confirmation from the fact that land becomes so to speak infected." In proof of this statement a very striking and singular case came recently under my own observation. I laid several cart-loads of diseased turnips upon a lea field, on four different places, to be cut into boxes for sheep; last year the field was in turnips, and on the four places where the turnips lay, and where they were eaten, the turnips were so diseased that by the end of August the spots were as bare as if the turnips had been pulled, while all around they were most luxuriant and healthy. I have observed, too, that farmyard manure made from diseased turnips affects the crop to which it is applied. Hence, if a farmer has one diseased field, the probability is, that the disease will be extended to another.

The best preventive or remedy for the disease.—Various are the

means which have been tried to cure finger-and-toe. Deep ploughing, the substitution of another green crop in the previous rotation, salt, lime, &c., have each had their able and zealous advocates. In reference to the first of these—viz. deep ploughing—I have seen it tried with good effect; but unless it is accompanied with liming, the effect is very limited. With the exception of potatoes, I have found the substitution of a green crop in the previous rotation to have no effect whatever. I have tried the potato crop, however, with advantage. In the year 1845 I had turnips on a small field, which were greatly injured by disease in the following rotation; five years afterwards, the field was planted with potatoes, and the next crop of turnips in 1855 was perfectly sound.

I mentioned salt, also, as having been tried as a corrective for the disease. In the year 1852 I used it with beneficial effect, the result of which I communicated to Mr Hall Maxwell, which was afterwards noticed in Dr Anderson's report. After repeated trials, however, since that time, I have no hesitation in saying that salt is no remedy for the disease whatever. I have applied so large a quantity of it per acre to a turnip crop as partially checked vegetation, notwithstanding the turnips were destroyed with finger-and-toe. In justice to the Highland Society, therefore, as well as to myself, I feel warranted to state that the conclusions I previously came to, in regard to the remedial properties of salt, were quite erroneous; not certainly that the result I gave was incorrect, but I am inclined to think that the difference between the salted and unsalted turnips was chiefly in appearance, and caused by the singularly dry season—the salt preserving the healthy hue of the turnips, from its well-known properties of retaining and attracting moisture.

Lime was the last remedy I named; and in reference to it, as I have done hitherto, I shall limit my remarks to the results of my own experience.

In 1851 I limed a field before sowing turnips upon it. The field was bad with finger-and-toe the previous rotation. The lime, when applied, was as hot as it could possibly be, and was well harrowed in on the surface before drilling the field. The quantity applied was 7 tons per imperial acre. As the field was likewise newly drained, I anticipated a large and healthy crop of turnips; but, alas, I was disappointed. Shortly after the turnips were singled out, the disease made its appearance, and by the beginning of September two-thirds of the crop were destroyed. In 1856 the same field was in turnips; and, with the exception of a bare and rocky corner of the field, they were an excellent crop, with no disease. Another field of twenty acres, where I intended to sow turnips in 1855, I by way of experiment limed different portions of it, at three different times before sowing them. A third part of the field was limed on the furrow before sowing the oat crop the year pre-

vious; another third was limed, in the autumn, on the stubble of the oat crop; and the remaining third was limed on the surface of the fallow, and harrowed in immediately before the turnips were sown. On the part of the field which was first limed, there was scarcely a diseased turnip, while on the other parts (between which there was no difference) there was not one sound turnip for thirty diseased, excepting where the Swedish variety were sown, which were about half diseased. All the turnips in the field brairded equally well; and about six weeks after being singled out, presented an unusual luxuriance, which attracted the attention of every passer-by. I knew, however, from frequently inspecting the roots, that all was not right with the parts of the field latest limed, and that the extremely luxuriant hue was preserved by the frequent showers and genial weather which prevailed. This was soon amply verified. Two days of withering drought succeeded the genial weather; the first of these days completely "felled" the shaws of the turnips, as farmers term it; on the second day one half of the turnips were detached from the soil as if pulled, and the diseased part of the field looked in the distance like newly mown hay. The form of the disease that chiefly prevailed was of the worst description, which I have already noticed under No. 5. I may state that the field, with the exception of liming at different periods, was treated every way alike.

My experience then leads me to the conclusion that lime is the best and only cure for finger-and-toe; and I believe, if applied in a caustic state, and in proper quantities, two years previous to the turnip crop, in almost every case it will mitigate if not altogether remove the disease. If I am correct as to the cause of the disease, of which I entertain not the slightest doubts, it is quite apparent why lime applied immediately preceding the turnip crop does not remove the disease. It may destroy the insect in its pupa state, which I believe it does; but in spring, the perfect insect is disengaged from its casement before the lime is applied, and is as free with lime as without it to deposit its ova in the turnip. On the other hand, where lime is applied two or three years preceding to the turnip crop, it destroys the early stages of the insect; and the perfect insect, which it cannot destroy, having fulfilled its term of life ere the crop is sown, all the media for future propagation of its species are destroyed.

Somewhat akin to this is, I apprehend, the reason why finger-and-toe is not so destructive on clay soils. The pupæ are locked up in the plastic clay, and when the period of transformation comes, the perfect insect cannot escape from the clod, and therefore dies.

It may be said that in this report I have only discussed the existing cause of the disease, and have left unnoticed the predisposing causes; or, in other words, have merely stated that insects

produce the disease, and left unexplained the reason why they attack one field and not another, or one part of a field and leave other parts untouched. Now, there are anomalies in connection with this subject which I do not pretend to explain, and probably an explanation of the one I have cited is involved in a knowledge of the previous treatment of the fields: for example, the diseased part of a field may have been ploughed wet, or much trampled, which induce the disease, or it may not have been limed equally with other parts of the field. Be this as it may, the anomaly which I have alluded to is no more inexplicable than many of the operations of the insect world. We see that the caterpillar of the cabbage-moth destroys the cabbages in one garden, but leaves those in other gardens unhurt; the gooseberry caterpillar denudes one bush of its foliage, and leaves another unharmed. Now, although these insect movements are apparent to the most casual observer, yet neither practice nor science have yet fully explained their cause. The more closely we examine the subject, however, the fewer difficulties appear; and what seemed at first palpable contradictions, become harmonious truths. In a word, finger-and-toe opens up a wide field for inquiry, and is a pleasing as well as profitable subject of research.

ON THE BEST MODE OF MAKING DUNLOP AND CHEDDAR CHEESE, AND ON THE COMPARATIVE ADVANTAGES OF THESE TWO VARIETIES.

By JAMES FULTON, Temple, Maryhill, Glasgow.

[Premium—The Gold Medal.]

IN responding to the call made by the Highland and Agricultural Society for a "Report on the best mode of making Dunlop and Cheddar cheese, and on the comparative advantages of these two varieties," the reporter is aware of the responsible position he has taken. The subject is a most important one, and requires for its elucidation a familiar acquaintance with the art of cheese-making; experience in relative practical and commercial matters; together with a competent knowledge of chemistry and general science.

The object of the report he conceives to be, to obtain in detail, and ascertain by contrast, the best mode of making "Dunlop and Cheddar cheese," so that parties interested in their manufacture may be enabled to form an opinion of their merits.

Brought up on a dairy-farm, and having devoted much time and attention to improvements in cheese-making, the reporter indulges the hope that the report now submitted will be found worthy of consideration. At the same time, he does not presume to bring to

the task qualifications equal to its importance, being influenced more by a sense of that duty which all owe to society, to communicate such facts and observations as they may have discovered in their peculiar sphere of labour.

Dunlop cheese derives its name from the village of Dunlop, in Ayrshire, where it was first made, at the farm of the Hill, in 1688.

According to tradition, it owes its origin to one Barbara Gilmour, who fled to Ireland during the persecution in the reign of Charles II., where it is said she learned this mode of making cheese.

It was at this time believed that sound cheese could not be made from new or full milk, and her success being attributed to *supernatural agency,* she narrowly escaped the penalty awarded to witchcraft at the cross of Irvine, as a reward for her innovation.—Records are extant in the town of Irvine.

It appears that the manufacture of Dunlop cheese was long confined to the locality of its birth; for it was not adopted in the other districts of that county until the lapse of more than a hundred years, and then only by farmers who had settled there from the neighbourhood of Dunlop. At the end of the last and beginning of the present century, however, it was generally adopted in the south and west of Scotland, where it has for many years been extensively manufactured.

The mode of manufacture here to be detailed, is that practised by the best makers in the parish of Dunlop, and other parts, including amongst them some of the descendants of the family of the originator. This mode the reporter has had the opportunity not only of witnessing, but of taking part in, for more than thirty years. It is, therefore, not only the original, but the best mode of making Dunlop cheese. The process is as follows:—

At six o'clock morning and evening, the steeping-tub—the wooden vessel in which the milk is coagulated—is set into its place, and across it is laid the little wooden framework called the milsey barrow. On this is suspended the milsey or sieve, through which the milk, as brought in from the cows, is strained to free it from hairs and mots. Milking is then expeditiously proceeded with—an operation that usually occupies about an hour or an hour and a half. When all the milk is got into the tub, the froth which collects on the top is gathered with the skimming-dish, and returned through the milsey until it has all disappeared. The rennet is then added to the milk, with which it is intimately mixed by stirring with the skimming-dish, and left for coagulation. A cloth is thrown over the tub to prevent cooling, and to protect it from dust.

Properly Dunlop cheese is made from new-drawn milk, but on Sundays the milk is stored in coolers in the milk-house until Monday morning, when it is skimmed, the cream put into the steeping-tub, and the skimmed milk into a boiler to warm. When the temperature of the latter is raised to a little above the heat of

new-drawn milk—as determined by the dairymaid's finger—it is emptied from the boiler into the steeping-tub amongst the cream, and along with the Monday morning's meal of new-drawn milk. It is then set with rennet, and treated exactly as above described.

When the quantity of milk at each milking is too little for a cheese, such as occurs in spring and winter, two or more meals or milkings are put together in the same way, or the curd is gathered until the quantity be sufficient for making a cheese, which is indeed the practice regularly followed in dairies of only a few cows.

The thermometer not belonging to the implements of a Dunlop dairy, the temperature of the milk, when the rennet is added, is only ascertained by the hand of the dairymaid. From observations taken in several dairies, the temperature was found to range from 87° to 103°, which lost, during the period of coagulation, from 1 to 3 degrees.

The chemical condition of the milk, when steeped new-drawn from the cows, was found to be alkaline; where the evening and morning meals were put together, it was neutral; and when three or four meals were put together, as on Monday morning, it had an acid reaction.

The rennet, or steep, as it is also called, is solely prepared from the cured stomach of the sucking-calf. With the view of obtaining a uniform good quality, four or five well-seasoned stomachs or bags, or equal portions of these numbers, according to the quantity required, are generally prepared at a time. These are cut into small pieces, put into an earthen jar or mug, and water, previously boiled, with a handful or two of salt, cooled down to milk-heat, is poured on them, in the proportion of half a gallon (5 lb.) to an ordinary-sized bag.

The whole is left to infuse for a week, at the end of which period, the infusion or liquor (now called steep or rennet) is well-strained, bottled up for use, and the exhausted membranes thrown away. The rennet is then ready for use.

In some dairies the bags are retained in the infusion. As the steep is drawn off for use, water or new whey is added as long as it continues to act. It is thought that, in this way, the bags go farther, but the rennet is less uniform in strength; and if the addition of salt be omitted, the bags are liable to decompose, and emit an offensive odour.

The bags are procured from the butcher, and contain a quantity of salt, and sometimes a little curdled milk.*

The quantity of rennet is measured by the time occupied in coagulation. As much rennet is added as effects this part of the process in about fifteen or twenty minutes; but occasionally, when

* The stomach of the suckling lamb yields a rennet equal if not superior to the calf. Why are they not preserved?

new untried rennet is used, the time of coagulation may vary from five minutes to an hour. When the strength of the rennet, however, is once ascertained, the specified time can be regulated with considerable accuracy, and this is one good reason for making the whole of the rennet, or at least a large quantity at a time, of a uniform strength, at the beginning of the season. If properly filtered, and saturated with salt, it will keep for years.

It may be stated that, in many dairies, less time is allowed for coagulation than that above indicated. Those who go through the operations coolly, and are economical of the rennet, use no more than what is necessary; but coagulation being that part of the process about which most anxiety is felt by the dairymaid, as on the well and speedy coming of the curd depends the success of the process, in so far at least as the saving of time is concerned, inducements exist for hurrying this part by adding too much rennet, which the over-anxious and those wishing to get over the work—as happens in the case of evening steeping—are very apt to do; yet slow coagulation is necessary to induce the chemical changes requisite for the production of cheese of prime quality.

When the coagulum is ready for breaking up for the separation of the whey—a condition indicated by a certain firmness to the hand, and the appearance of greenish whey on a little part being broken—it is cut across, from top to bottom, with a long-bladed knife, so as to leave it in pieces of about two inches square, and left for about ten minutes. It is then more minutely broken up with the dairymaid's hands, or by stirring it very gently and carefully from top to bottom with the skimming-dish.

The breaking up being finished, a few minutes are again allowed to admit of a little settling down of the curd. The dairymaid and her assistants then place themselves beside the tub, and, immersing their bared arms into the mass, assist by gentle pressure the separation of the whey and subsidence of the curd, which experienced hands do in a dexterous and efficient manner, putting down the curd evenly and firmly to the bottom of the tub.

There are other plans and contrivances in use for gathering the curd and separating the whey, but they scarcely claim notice in a report of the best mode, as it is the opinion of the best makers that none of these can equal in utility the dairymaid's hands and arms, owing no doubt to the peculiar gentle pliant mechanical action, of laying and sinking, lifting and shifting, and of feeling when, where, and how to apply, as well as the chemical agency which the natural warmth of the arms communicate.

When the arms are employed, the greater part of the whey is allowed to remain over the curd, until it is collected at the bottom, by which means the heat—so essential in promoting the separation of the whey and chemical changes of the curd—is retained; but by the other plans alluded to the whey is drawn off as it comes, and

allows the curd at this early stage to cool down too low, which causes both trouble and loss in the after extraction of the whey.

Some writers, it is true, object to the use of the dairymaid's arms, on the supposition that the heat of the arms causes a separation of the butyraceous matter from the curd, which, they say, is carried off in the whey. But the heat of the arms being no warmer than the natural heat of the milk, the objection is groundless; it might as well be said that the heat of the cows' udders would cause such a separation. But to return to the process.

When the dairymaids have succeeded in putting down the curd, the next operation is to lade out the whey, which, to save loose pieces of curd, is passed through a sieve. The curd is then cut into intersections of about 4 or 5 inches, and again gently pressed for a short time with the hand.

In order to facilitate the extraction of the remaining whey, the tub is now raised a few inches on one side, and part of the curd removed from the lower to the higher side, which furthers the discharge, and makes space for collecting and lading out the whey.

This being done, the curd is left to drain until it becomes firm enough for being lifted with the hand into the dreeper, receiving during this time several cuttings, and, if found necessary to forward the process, a slight pressure with the hand.

The management of the curd during its progress through the dreeper—a part of the process very systematically followed in some dairies—now falls to be described.

Having attained the proper degree of firmness, the curd is transferred to the dreeper—a utensil in shape exactly like a cheese-vat, only of larger diameter and a greater number of holes—which being suspended on the dreeper barrow laid across the whey boyne, was previously set beside the steeping-tub. An hour from breaking up of the coagulum until the curd is got into the dreeper is about the average time for this part of the process. Of a number of observations, the mean temperature of the curd, when put into the dreeper, was 79°.

On being put into the dreeper the curd receives eight cuttings and changings, to effect the discharge of the whey before it is dry enough for making up into a cheese.

The first cutting is given ten minutes after the curd is put into the dreeper, the second fifteen minutes, the third twenty minutes, and so on at the same ratio, always allowing five minutes more to elapse between every subsequent cutting. The mode of doing it is this:—

When put into the dreeper, the cloth, which is placed inside to prevent the curd from filling up the holes and otherwise to aid the free discharge of the whey, is gathered up at the corners and fastened. The lid is then laid on, and a light pressure of 16 or

20 lb. applied, which is gradually increased: when the curd is to be cut, it is lifted out of the dreeper and laid upon the lid, which, in taking off, is laid close to, to receive it. The cloth in which the curd is enveloped is now wrung out of warm water, and again placed inside of the dreeper, into which the curd, as it is cut, is again laid, cutting it the first time into large pieces, which, as the curd becomes firm, is reduced every subsequent cutting until it is made quite small; thus gradually cutting smaller, extending the time between the cuttings and changings, and increasing the pressure as the curd becomes firmer and drier, until it is ready for being made up into a cheese.

The last three cuttings are generally given in the curd boyne with the champing-knife; or in dairies furnished with a curd-mill or breaker, the last cuttings are given with this implement. Some eminent dairy-managers, however, prefer the knife to the curd-mill, because, as they say, the bruising action of the latter causes too much of the substance of the curd to be carried off in the shape of white whey. Indeed, great care is required in the performance of all the cuttings, otherwise white whey is sure to escape.

When the milk is steeped at night, the curd, after receiving three or four cuttings, is left in the dreeper till morning, when at an early hour the process is resumed.

The time occupied with and between the cuttings and changings in the dreeper is usually about two hours. If the rennet be added by half-past seven, the curd should be ready for making up into a cheese by twelve or one o'clock.

This brings the process up to an important stage—the curing of the curd. Salt is the only substance hitherto in use for this purpose: a little is sprinkled on the curd when left in the dreeper at night, and the same in the forenoon if the weather be sultry; but the salting is always completed with the last cutting or breaking of the curd, and it is proper to mention that curd left over is now added, being first well warmed before the fire.

As the curd is never weighed, there is no established rule as to the proportional quantity, this being indicated by an agreeable saltish taste which the cultivated palate of the experienced dairymaid can regulate with tolerable exactness. Generally there is a consultation held over the salting, the remarks on such occasions being, "It is just right;" "It will do—the curd is pretty dry;" or, "The curd is soft;" or, "The weather is sultry—it will be the better of a little more."

In a number of dairies where the proportion of salt was ascertained, the average was 1 ounce to 3 lb. of curd. The Prestonpans or Saltcoats dairy-salt is generally used.

In dairies where the cheese-room is in a garret immediately under a slate roof, the proportion of salt requires to be high. Such roofs, let it be remarked, should be washed with white lime,

in order to reflect the rays of the sun, which the natural colour of the slates absorbs.

When the salt is added and well intermixed, a clean cloth wrung out of warm water, to prevent the curd adhering, is placed inside of the cheese-vat, and the reduced curd firmly pressed into it with the dairymaid's hands and rounded on the top, over which the ends of the cloth are lapped, and fastened in at the edges of the vat. The lid or sinker being adjusted on the top, it is now ready for the press; but before doing so it is first placed near the fire for about two hours, and turned until it is warmed regularly all round, with no other pressure at first than the lid of the vat, and afterwards a light weight of 20 or 30 lb.

In some dairies a different method is followed. In these it is at once put to press, under heavy pressure, for 2 or 3 hours, then it is put for half an hour into a warm-water bath of about 120°; a clean dry cloth is then put on it, and it is returned to the press.

The former practice, however, will be found to be the best. During the time the vat has remained at the fire the greater part of the whey remaining in the curd will have percolated and run off quite clear; but by the practice of putting to press and applying heavy pressure immediately on the vat being newly filled with the finely-divided curd, white whey will be forced out; and again, the softening of the cheese in a warm-water bath or in a stove, after compression and cohesion of the particles and closing up of the pores have taken place, tends to obstruct the expression of the remaining whey.

But to the process. After having remained due time near the fire the vat is placed in the press, and pressure gradually applied; and if put to press in the afternoon before the cows are brought in for milking, the young cheese should be ready for changing when the milking is over, or in about two hours after being put to press. (Changing, it may be proper to mention, is the removing of the wet cloth, applying a clean dry one, reversing the cheese in the vat, and again putting it under the press.)

The vat is then taken from the press, and the cheeseling shaken out on the lid of the vat, which, in the act of taking off, is laid smooth side up. A clean dry cloth is then laid over the cheese, and the vat, which is held between hands, mouth downwards, pressed over it; the vat with its charge is then overturned, the lid adjusted, and again subjected to pressure.

About 9 o'clock, or before bedtime, the second changing is given. Early next morning it receives another dry cloth, and at this time, if the weather be cool, the vat is well warmed at the fire.

It is changed again at 10 and 2 o'clock, and if the stoning has gone on well—a condition indicated by an uniform yellow colour and by an elastic feel to the touch—it should be ready for taking

from the press that afternoon; but some managers, with the view to better maturing, prefer continuing the pressure 12 or even 24 hours longer. If the cheese be large this is commonly allowed; and in some dairies, before final removal from the press, the cheese is put under pressure with a cloth wrung out of hot water, to give toughness to the skin, and afterwards put into the bare vat for half an hour or so—slight pressure being applied in order to smooth the surface.

When heat is husbanded in the early stages, and the cheese-press stands in a warm place, less difficulty will be experienced with the stoning; but if at the end of 24 hours after being put to press there is still whey remaining—which is easily detected by wet spots on the cloth and white spots on the cheese—it is put into a warm-water bath—the stove—or set near the fire as before, and changes of dry cloths with increased pressure continued, until it be quite dry. The cheeses, as withdrawn from the press, are usually laid on a table in the kitchen for two or three days, and frequently turned. This is done in case whey spots should again appear in them.

They are then removed to the cheese-room and turned daily for ten or fourteen days, and afterwards at longer intervals as they become firmer and drier. The cheeses are kept as much as possible from extremes of cold and heat.

A compost of lime and sand is kept in a box in the dairy, for cleaning and scouring the knives used in cutting the curd, and the other utensils. Indeed, in the class of dairies to which these remarks apply, the most scrupulous regard is paid to cleanliness in everything.

The reporter has only further to remark, that although the above is a correct report of the best mode of making Dunlop cheese, but little is now made by this recipe—there being few dairies in which more or less of the Cheddar mode is not adopted, and which in many dairies has entirely superseded the Dunlop

The mode of making Cheddar Cheese, celebrated for its superior qualities, now falls to be described. Its name is derived from the village of Cheddar, in Somersetshire, where it was first made.*

* The following historical remarks were kindly communicated by Mr Joseph Harding of Marksbury, near Bristol, to whom the mode of making Cheddar cheese, as now improved, is chiefly due.—This variety of cheese derives its name from the village of Cheddar, in Somersetshire. Until some time in the last century, when it originated in the small farmers of the village agreeing to put the milk of their cows together on alternate mornings, and thus have the advantage of making a large cheese, Cheddar had not a name for cheese-making. On account of the novelty, it soon obtained a name by which all thick cheeses made in and around the county of Somerset are still known. The improvement in the article itself, however, did not commence until long after it acquired its name. In my own recollection it was made in a way very similar to the Dunlop, with a combination of the Cheshire and Wiltshire systems, involving immense labour.

About 30 years ago a spirit of emulation was excited by the appearance here and

The following is the mode adopted in the first dairies in that part of England.

It may be well at this stage to make the reader acquainted with the implements and utensils used in the preparation, and which are well adapted for the purpose. These consist of—

1. A tin steeping-tub with convex bottom, and spiggot for drawing off the whey.
2. A skimmer made of tin, and in form something like the shell *pecten*.
3. A white-iron bowl for lifting milk and whey.
4. A milsey or strainer, with barrow made of tin.
5. A small tin or pan for warming milk and whey.
6. A large tin or pan for do. do.
7. A revolving breaker or agitator, made of iron, for breaking the coagulum.
*8. A small scoop for lifting the curd into the curd-mill and cheese-vat.
9. A thermometer.
10. A steelyard or spring balance, for weighing the curd.
11. Scales for weighing the salt.
12. Cloth fillets or bandages for the cheese, together with curd-mill, whey boynes, cheese-presses, &c., as in other dairies.

As some of the minor details already given are common to both the Dunlop and Cheddar varieties, their repetition is unnecessary.

Cheddar cheese is made only once a-day, commencing in the morning. The evening's meal of milk, as brought in from the cows, is at once strained into the steeping-tub in the dairy, where it remains until morning, when the morning's meal is added to it.

In sultry weather, where the quantity of milk is large, part of the evening's meal is kept separate in coolers.

If the heat of the mass, when the evening and morning meals are put together, be under 80°—the temperature at which the milk is set with the rennet—as much of the evening's milk is warmed

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there of a superior lot of cheese, realising in the markets a much higher price than that of their neighbours. Many of the cheese-makers of this county turned their attention and energies to the subject, and the result was that the old system was thrown aside and a new one adopted—the principle of which was immersing the curd or "gurth," in large lumps, into nearly boiling whey. It was at this time thought that a cheese made with all the cream in it would be too rich, and would not hold together in consequence. A better cheese, however, was produced, and a better price obtained; but the labour was still unabridged. Fifteen years ago, Mrs H. and I, with a few others, started with the object before us of producing the best cheese with the least amount of labour. By means of experiment, and a careful study of the progressive changes in the curd, we were soon enabled to lay down a course from which we have not yet seen it necessary to deviate. The heated whey is applied soon after the coagulum is broken up, and is what is here technically termed "slip scalding"—a system adhered to at present by the best and most extensive cheesemakers that I know of in this country.

* The first eight of these implements, made of the best material, and of improved construction, may be had from John Becket, brassfounder, King Street, Kilmarnock; cheese-presses of superior power and workmanship from J. and F. Young, Vulcan Foundry, Newton Green, Ayr; cheese-vats of first style and quality are made by Mr Armour, cooper, Neilston.

to about 100° as will raise the temperature to the required heat, which is accurately determined by the thermometer. In cool weather the temperature is made 2° or 3° higher.

The milk to be warmed may be taken from the milk in the tub before the morning's meal is added,—putting aside the cream with the skimmer while the milk is laded out; but if the weather be very sultry, the milk to be warmed will be better to be kept separate in a cooler. It is then set into a boiler of warm water to heat in the small tin pan, a little quantity in general being only required.

As the milk for the preparation of Cheddar cheese requires to have an acid reaction when the rennet is added, sour whey or milk, varying in quantity according to the state of the atmosphere, is put into it,—more of the acidifying agent* being applied as the weather is cool, and less as it is warm. This part of the process, however, is not as yet very refined.

The proper condition is the presence of a free acid which distinctly reddens blue litmus paper, a condition but faintly appreciable by the most cultivated taste. The quantity of sour whey, from the want of a proper index, has just to be guessed at; hence it not unfrequently happens that too much or too little is put in.

In several dairies, lately visited by the reporter, in Ayrshire and elsewhere, all the managers stated to him that they experienced great difficulty in regulating this, the most essential point. Opportunities were thus afforded him of introducing and explaining the usefulness of litmus paper, which, although not indicating exactly the degree of acidity, will be found a valuable guide.†

For this the managers were grateful, and as a proof of its utility, several of them now prepare the paper themselves—a circumstance which many will regard with satisfaction, as evincing not only an enterprising spirit amongst Scotch dairy-managers, but also a determination to be second to none in Europe for good management and the quality of their cheese.

When colouring matter is used, it also is added before the rennet; and if the cheese be intended for sale in the English or Irish

* Tartaric and citric acids deserve a trial, as vegetable acids are said to precipitate most curd from the milk.

† As this part of the process cannot be regulated with chemical exactness without the occasional use, at least, of an acidimeter, it is to be hoped that ingenuity and science will ere long put a simple instrument into the hands of the dairymaid. The reporter respectfully suggests that a set of dairy chemical instruments should have a place in the Society's prize-list, and that, as the Society's shows are beginning to assume a more scientific character, their chemical officer, assisted by a practical scientific man, should be appointed as judge.

These instruments might consist of an acidimeter for measuring the acidity of the milk and whey; a thermometer adapted both to solids and liquids—for curd as well as milk; an apparatus for filtering rennet, and perhaps a few other inexpensive articles, without which there can be no refinement in the dairy.

markets, or even to compete in the home market with first-class cheese, colour is a matter of considerable commercial importance.

The shade of colour most admired is a bright amber tint, and those who give due attention to this point, generally manage to impart it.*

While the dairymaid is preparing the milk for setting with the rennet, an assistant takes the white-iron bowl and skims a quantity off the top of the milk, which she pours gently back into the mass. This is done with the view of sinking the cream, which has a great tendency to rise to and keep on the surface.

As soon as the milk is ready, the colouring done, and the temperature and chemical condition adjusted, the rennet is put in, and the whole thoroughly and intimately intermixed by stirring with the skimmer. This part of the process is usually accomplished by seven or half-past seven o'clock.

As much rennet is added as effects coagulation in about an hour; but it is better to be fifteen minutes more, than any less. The preparation of the rennet is much the same as that described in reporting on the Dunlop mode, with the exception that a little lemon-juice is added by some to improve the flavour.†

As soon as the coagulum has acquired the proper degree of consistency, it is partially broken in order to draw a small quantity of whey to be heated, and again returned to supply the 3° or 4° of temperature lost during coagulation.

The breaking is performed in some dairies with the skimmer; in others with a long-bladed knife dividing it into intersections as in the Dunlop. And before breaking, some managers cover the surface about 2 inches deep with a part of the coagulum taken from one place at the side of the tub. This is done to prevent any cream that has risen to the surface being carried off with the whey.

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* Nicholl's celebrated liquid extract of annato, manufactured by Nicholl, Chemist, Chippenham, Wilts, and sold by Rankin, Druggist, Kilmarnock, is extensively used. It can also be had, as well as English rennets, at the Apothecaries' Hall, Glassford Street, Glasgow.

† Most of those making Cheddar cheese in Ayrshire procure their rennets from Mr Oulton, calf butcher, Cable Street, Liverpool, where, by cutting away all superfluous skin and fat, and by thoroughly washing all impurities from the inside of the bag before salting, they are cured in a much more cleanly manner than by the Scotch butchers, and they are also cheaper. Yet it must not be concealed, that rennet is scarcely anywhere prepared in the dairy as it might and ought to be; chiefly, because the dairy is not furnished with a simple filtering apparatus, for freeing it of the organic matter in suspension, and from a high standard of purity never being seen.

The preparation of rennet must be defective while it has a disagreeable appearance. Rennet, as prepared by Crosse and Blackewell, Soho, London, is as pure as brandy, inviting both to the eye and the palate, and is extensively used by dyspeptic and consumptive patients.

The Society would surely do well in directing their efforts to the improvement of this, the radical part of the process of cheesemaking. The award of prizes for the best and purest rennet would surely have the desired effect.

Being allowed fifteen minutes to come, the whey is drawn off into the small tin, and set into a boiler of hot or boiling water to warm. While the whey is heating, the coagulum is minutely broken; where there is a revolving breaker, the operation is performed with this implement, which is then introduced into the tub.*

When both are ready—the coagulum broken, and the whey heated to 100°—as much of the latter is poured into the mass as will raise it to 80°, the temperature at which the milk was set with the rennet. In cool weather the temperature may be raised to 82° or 83°.

While the heated whey is being poured in by an assistant, the dairymaid keeps the breaker in motion.

From the first breaking-up of the coagulum to the end of this part of the process, the time occupied is usually from thirty to forty minutes. It is then left for half an hour, at the end of which period more whey is drawn off to be heated.

A greater quantity being this time required, the large tin pan is employed. When the whey heating in the pan is nearly ready, a quantity of the whey in the tub may be taken out.

The breaker, or agitator, as it is also called, is then set in motion, and the curd again gently and minutely broken up into very small pieces, in preparation for being acted upon by the hot whey, which is heated this time to 140°, and as much of it returned as will raise the temperature of the mass to 100°, or in cool weather to 102° or 103°. It should be ascertained that acidification has advanced to the proper stage before the hot whey is returned, as the whey will then retard its progress. Every dairymaid knows that scalding milk or whey arrests acidification, although it is not known what degree of temperature has the maximum effect in accelerating it. When acidification has advanced too far, it can be

* Perhaps it would be as well to pour in the heated whey before introducing the breaker, as warmth and firmness would be given to the curd before, or in the act of breaking. Objections have been taken to much breaking of the curd in this cold, tender stage, as it causes the separation of white whey, to obviate which invention has been stimulated. A thermal curd-knife or breaker was exhibited at the summer show of the Glasgow Agricultural Society, 9th June 1858, and may yet prove the germ of an implement calculated to perform this part of the process more scientifically.

The principle of this thermal implement is, that by means of double blades filled with hot water, wrought very slowly and gently, it warms in the very act of breaking, perfecting coagulation, and causing the curd to contract and relinquish its attraction for the whey, which comes away quite green, and which supersedes as designed the first warming of the curd with heated whey.

The idea of warming, by means of a tub having double sides and bottom containing hot water, has also suggested itself; but it is doubted that in this way the curd would not be so regularly warmed as by introducing heat directly into the mass. A tub of this construction, however, would be very useful in warming the milk, and in maintaining the temperature.

The vacuum itself would retard the loss of heat by radiation, and by pouring in a little hot water the whole tub would be surrounded with steam or warm vapour.

brought back by adding bi-carbonate of soda or potash to the whey when it is put into the boiler to warm.

During the pouring in of the whey, which should not be rapid, the mass is kept in active motion with the agitator, which is sometimes reversed to prevent any portion of the curd being too much heated. When brought to the proper temperature determined by the thermometer, the motion, as the curd requires to be kept in suspension, is continued with the agitator more slowly for twenty-five or thirty minutes, or until the pieces of curd acquire the proper degree of consistency, which is known by a certain elastic granular feel when grasped in the palm of the hand.

The breaker or agitator is now removed, and half an hour allowed for the subsidence of the curd.

The half-hour having passed, the next operation is to draw off the whey.

That portion of it standing above the curd is laded out with the white-iron bowl, after which the spiggot is withdrawn, and the remainder allowed to run off at the bottom, to facilitate which, the side of the tub opposite to the spiggot is raised a little.

When the loose whey has run off, the dairymaid, with the skimmer in one hand, gathers the curd from the side of the tub, and makes it up into a round heap on the centre. If the bulb of a thermometer be inserted into the heap, the indication will be about 90°. In this state it is left for half an hour without any pressure being applied.

The curd being at this stage a granular mass, and quite porous, the whey drains rapidly out, and runs off nearly as pure as water.

At the end of the half-hour it is cut into four or six pieces, turned upside down, and left as before for another half hour, when the curd will be found to be firm, cohesive, nearly free from whey—to have a slight sourish smell, and when broken between the hands it peels off something like the peeling of an onion; the temperature will then range from 80° to 85°.

It is then broken with the hand into thinish pieces, and as it should not be subjected to pressure much above 60°, it is laid out over the bottom of the tub for half an hour to cool.

If the temperature of the dairy-room be higher than 60°, as many dairies are in the warmer season, the curd is placed into portable coolers and removed to the milk-house, or the cooler is set into a vessel containing cold spring-water—the only refrigerator of the dairy—in order to reduce the temperature as near as possible to the proper degree.

The curd is then put into a vat, in which a cloth is placed. If the quantity be large, it is, with a view to lighter handling, divided between two cloths, moderate pressure being applied for about an hour.

When the curd is taken from the press, the ends of the cloth or

cloths are tied, and it is hooked on to the little spring-balance hanging on the lever, and weighed. On being weighed, the curd is passed through the curd-mill, after which it is salted, and again passed through the mill, in order to break it down small, and incorporate it with the salt—the quantity being 1 lb. of refined or stoved Cheshire salt to 56 lb. of curd, or 1 ounce to 3½ lb.*

The curd is then made up into a cheese or cheeses, as the case may be; and, as another matter of considerable commercial importance, the size should be determined by the quality. If the quality be fine, the larger the better; but if secondary, a medium size is preferable. The large size (70 or 80 lb.) obtains the highest price in London and other large cities, while the medium size (35 or 40 lb.) is more sought after for the provincial market, and for exportation.

Economically, again, the loaf size, which sells high, is best adapted for small dairies.

If a Cheddar price be expected, the cheeses must be fashioned on the recognised Cheddar shape and style.

When the curd is made up into a cheese—a stage usually reached by two, or from two to three o'clock—it is put into the press, and there remains until morning.

Pressure being gradually applied, no weight is put on the lever for the first half-hour; a light weight is then hung on, and at seven o'clock full pressure applied. Next morning, after the milking and setting of the milk are over, the cheese is changed, and very heavy pressure applied for twenty-four hours. On the following morning, a neatly-fitted slip of fine calico is put on the cheese to smooth the surface, moderate pressure being applied, and in the evening it is ready for the cheese-room.

When withdrawn from the press, the cheese is laced into a piece of stout linen or cotton cloth called a fillet or stay, which is kept on until the cheese is ready for sale, or has become quite firm.

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* A ready reckoner, something in form of the following specimen, on the above proportion, should be hung up in every dairy, to assist the dairymaid in calculating the quantity of salt.

Curd. lb.	Salt. oz.	Curd. lb.	Salt. oz.
14	4	59½	17
17½	5	63	18
21	6	66½	19
24½	7	70	20
28	8	73½	21
31½	9	77	22
35	10	80½	23
38½	11	84	24
42	12	87½	25
45½	13	91	26
49	14	94½	27
52½	15	98	28
56	16	101½	29

This fillet or bandage is put on it to preserve the shape, and it serves the other useful purposes of keeping the cheese clean, preventing it from cracking, and protecting it from the attacks of insects. It is then removed to the cheese-room, and this brings the process to the last but not the least important stage,—the ripening of the cheese.

A new class of changes now take place in the cheese; the acidity which disappears in the process of ripening, is either neutralised or volatilised, probably it combines with some alkali developed by the decomposition of the casein. If so, the acidity has here an important use.

The cheese-room requires an atmosphere neither very dry nor very moist, the exclusion of light and the admission of fresh air under proper control, so as to exclude it when cold and damp; but the principal condition is an equable warm temperature, ranging between 60° and 70°.*

When the temperature requires to be maintained artificially, heat is applied by means of the stove; or if the room be conveniently situated, by hot-water pipes connected with the kitchen fire.

The cheeses are turned daily for about ten or fourteen days; afterwards at longer intervals, extending as the drying and ripening advance. Some cheese-rooms are furnished with a cheese-turner for the cheeses requiring daily turning, the oldest cheese on the frame being taken off as each new one comes from the press, and such an inexpensive and useful piece of furniture no cheese-room should be without. Turning large soft cheeses with the hand is severe both on the person turning and on the cheeses.

The reporter cannot pass from this part without noticing the want, which is very generally felt and expressed, of cheese-room accommodation in carrying out improved modes of making cheese, and to direct attention to the importance, when supplying these offices, of due regard being paid to the proper situation, material, and construction.

It is proper here to remark, that although a specified time is laid down for the performance of the operations, no rule can supersede the exercise of the skill and judgment of the manager, who must hasten or delay the operations so as to suit the progress

* "Experience," writes Mr Harding, "has taught us how to keep or store the cheese after it is made. At first we thought it best to keep it for a time in a damp cool place, at about 45° F., but we soon found that such a low temperature injured rather than improved the flavour. We therefore introduced stoves into the cheese-room, and at once placed the cheeses from the press at a temperature of from 60° to 70° or 80°. By this method we found that a properly-made cheese would much sooner ripen, and I have sometimes known our own cheese cut over the counter at the highest price in Bath and Bristol before it was three months old, although it would be 9 or 10 inches in thickness, and 60 or 70 lb. in weight."

of acidification and other changes which are sometimes influenced by occult and unforeseen causes; and although the above be an accurate description of the best mode of making Cheddar cheese, no description, however graphic, can equal seeing the thing done. To observe and note the condition of the milk and curd, &c., in their different stages, to acquire correctness and dexterity in the manipulations, and to learn to give style and finish to the cheeses, requires the exercise of all the senses. Agricultural societies wishing to introduce the system would do well to follow the public-spirited example set by the Ayrshire Agricultural Association in bringing Mr and Mrs Harding from England to perform and explain the process, or to imitate those who, to perfect themselves, went to learn it in Mr Harding's own dairy.

As to the difference of these two varieties, the reader will perceive that, as regards the mechanical part of the process, the Cheddar is the more simple. The difference, however, is not to be found in the operations but in the chemical conditions, or in the application of those agents which operate upon the milk, and affect the chemical and physical character of the cheese, viz., rennet, acidity, and temperature, all of which, although producing different results, are to a certain extent equivalent to or substitutes for one another in coagulating energy.

In the Dunlop, coagulation is effected rapidly, with a large quantity of rennet at a high temperature, and an alkaline or neutral condition of the milk.

In the Cheddar, coagulation is slowly effected, with a small quantity of rennet at a low temperature, in presence of a free acid, or an acid reaction of the milk; thus inducing at the very commencement different changes, which are further affected by the modes of separating the whey.

In the Dunlop, the whey is separated by a process of continuous manipulation and mechanical force; in the Cheddar there is little manipulation, the separation of the whey being effected by the natural contraction and precipitation of the curd, aided by the chemical action of heat applied in the heated whey.

In so far, therefore, as the separation of the whey is concerned, the Dunlop may be said to be a mechanical, the Cheddar a chemical process.

As to the comparative advantages of these two varieties, the reporter, after a careful investigation, has come to the conclusion arrived at by all who have fairly tried both modes, that the advantages are wholly on the side of the Cheddar.*

These advantages, which are of an economical, dietetic, and commercial character, may be stated to be the saving of labour, the production from the milk of a larger quantity and a better

* See Appendix, No. II.

quality of cheese, which sells in the general market, on an average of years, at about £20 per ton more than Dunlop. This very year (1858), while the farmers' price for Dunlop was only from £48 to £50 per ton, Mr Harding, at the same period, sold his cheese at nearly £80 per ton. So much for the commercial advantage.

In regard to the dietetic: The too energetic coagulation and the mechanical force employed in separating the whey, causes the smothered fermentation which produces the crude quality and tenacity of texture characteristic of Dunlop cheese, and which makes it so indissoluble and difficult to digest.

The gentle coagulation and acid reaction of the milk, together with chemical means in separating the whey, gives to Cheddar its rich appearance and quality, and that peculiar mellow texture which renders it so soluble and easy of digestion, and consequently more nutritive than Dunlop. The flavour or relish is supposed to be due in some measure to the delicious aroma of the whey developed in the heating, and absorbed by the curd in the process of "scalding." A full and fine flavour might be imparted by distilling off the aroma of the whey, and adding it to the curd when being made up into a cheese.

As to the economical advantages: The mode in which the saving of labour is effected will readily occur to the reader. The larger quantity, as determined by experiment, probably arises from the presence of a free acid in the milk, which, acting as an additional coagulating agent, either assists or coagulates some substance in the milk not coagulable by rennet or in an alkaline or neutral condition, and thus precipitates from the milk a larger quantity of curd; at least the curd relinquishes more readily its attraction for the whey, which comes away more thin and limpid than in the Dunlop. The larger quantity also arises from the substance of the curd not being forced out in the form of white whey, as takes place in the Dunlop by the excessive manipulation and pressing in the dreeper.

In Cheddar cheese there is likewise a better combination of the caseous and butyraceous constituents than what obtains in Dunlop, which accounts for its more stable character. In the manufacture, the dairymaid finds less oil in the cloths—the cheese stands ripening at a much higher temperature—and is better suited than Dunlop for export to warm countries. To ascertain the cause of these different qualities belongs to the domain of chemistry. It may be mentioned that they are chiefly due to the result of some chemical change that takes place only when a free acid is present in the milk when it is set with the rennet.

The cause of the superior quality of English cheese, which hitherto has been attributed to the pastures,* will be found to be

* See Appendix, No. I.

owing chiefly and simply to a more perfect acidification, or lactic fermentation, so to speak, in the early stages of the process, induced by gentle coagulation, and an acid reaction of the milk.

It is, however, not to be expected that the conditions of the mode just described will prove to be the conditions best suited to the circumstances of *every* farm for producing the Cheddar texture and flavour. It may happen that on some situations the milk may require to be more or less acid; that on some pastures the temperature should be higher or lower when it is set with the rennet; or that on some soils the whey must be more or less heated. Neither is it to be supposed that Cheddar cheese has yet anywhere been made of such super-excellence as not to be surpassed. As the most suitable conditions for the circumstances of different farms can only be found out or improvement made by experiment and observation, means by which much has been and may yet be learned, and as experiments and observations can only be available when accurately kept and recorded, the reporter, with the view of encouraging improvement by supplying in so far the means, has framed the annexed Table for registering the conditions, or observations of the conditions, under which the cheese is made.

Each cheese to be dated with characters made of wood, or a piece of wire, for the month and day of the month corresponding to the entry in the table; so that at any future time, by turning up the register, reference can at once be had to the conditions under which the cheese was made.

It will be observed that some of the columns in the Table are designed to collect information of a statistical nature, which would prove useful in the elucidation of collateral points of scientific and practical interest.

Such a register or history, giving precisely the conditions on which they were made, should be sent in with every cheese exhibited for a prize. The mere exhibition of a cheese without knowing how it is made, communicates no information, or leads to little improvement. Like the cattle, they should bring their "pedigree" along with them.

The annexed Table is only submitted as a specimen which may be improved or modified to suit the objects in view. Such a Table, framed so as to record every condition of the manufacture, &c., will be indispensable should the Society resolve on offering well-directed experiments in cheesemaking, or of instituting an investigation into the nature and causes of the changes that take place, a knowledge of which would be of so much importance in the practical department. It is not to be wondered at that a great desire exists for the elucidation of the scientific principles involved, as there is scarcely any art, it is to be regretted, more destitute of well-ascertained facts. We have nothing but vague and conflicting opinions on many essential points instead.

Most dairy-managers are aware that rennet, acids, and temperature, are the agents that govern the changes of the milk; but in what manner, and to what extent, is very far from being known as it ought to be.

The separate and combined influence of these agents on the quality and quantity of the cheese, affords an untrodden and fertile field for conjoined practical and analytical research, which could not fail to result in important material and interesting intellectual rewards; a field which, it is to be hoped, will soon be entered upon.

The reporter has only to add in conclusion, that from the favourable nature of the soil and climate—the high intelligence—the spirit of enterprise and industry of the people—there is perhaps no part of the world better adapted for the successful manufacture of cheese of the first quality than the dairy districts of Scotland.

These natural resources, the proper appreciation of which would increase so much the internal wealth and general prosperity, had their claims pressed on public attention more than forty years ago, by the late distinguished President of the Board of Agriculture, who has recorded his opinion, that "the dairy is perhaps the most pleasing of all the departments of husbandry, and that by converting herbage into milk by means of a dairy-stock, is the most profitable mode of employing it, and the most productive of human food, and that it is supposed that the same quantity of herbage that would add 224 lb. to the weight of an ox, would produce 1800 Scotch pints (900 English gallons) of milk, or 860 lb. of cheese, besides the flesh that would be obtained by feeding pigs with the whey."

This opinion is concurred in by Professor Low, who observes that, by means of the dairy, a larger quantity of nutriment can be obtained from the consumption of an equal quantity of herbage, than by any other species of feeding. There is, however, another view in which the manufacture of cheese should be considered in the production of human food—viz., its high nutritive value. According to the result of analysis by eminent chemists, full-milk cheese contains sanguineous or flesh-forming constituents, 31.02; respiratory or heat-giving substances, 25.30; while butcher-meat, as found in the market, contains only 22.30 of the former, and 14.30 of the latter; or, in other words, 1 lb. of cheese is equal in theoretical nutritive value to a little more than 1½ lb. of beef. Johnston (at page 1027 of *Lectures*) states that, "to supply the body the daily waste of 3 ounces of fibrin, there must be eaten about 14 ounces of fresh beef or mutton, or 7 ounces of cheese."

As the character of the cheese is chiefly determined by the mode of manufacture *—a fact now satisfactorily attested—the importance

* This important fact, first promulgated in "Observations on Cheesemaking," has now been proved to a demonstration.

"Whilst in Ayrshire," writes Mr Harding, "we made cheese in almost every part

of giving to the dairymaid every aid which science and ingenuity can supply, scarcely requires to be mentioned, but the reporter cannot close without offering a few remarks on the commercial aspect of the subject.

Animated by new views, and stimulated by the success that has attended the introduction of an improved mode of manufacture, a spirit of improvement has been awakened in the dairy districts, which, if not damped by causes which individual enterprise cannot overcome, will not fail in leading to high results.

A quality of cheese is now made in several dairy districts, that will rival the best English in any market; but now that it is produced, the want of a suitable market is greatly felt.

The local dealers, it is said, are opposed to any change that will raise the price. It is likely more correct to say, that having, as yet no connection for the sale of imitation Cheddar, the local dealers do not encourage adapting the cheese for any other than the local market. The farmers, on the other hand, have no love of consigning, and here the matter stands.

It will readily occur to any one conversant with the practical and commercial bearings of the subject, and who has watched the phases of the cheesemaking movement, that a sure remedy for this state of affairs would be the institution of a great cheese fair or tryst, such as would be worthy of Scottish enterprise, which would be attended by merchants or their agents from all parts Were such a fair established, its business could be transacted at a time when the summer cheeses were ready, and to it the softest cheeses might be safely carried in hampers. The city of Glasgow will at once occur as the most suitable place; but wherever it may be held, until such a market is established, the laudable efforts of Scotch dairymaids will be inadequately rewarded, and the dairy resources of Scotland remain undeveloped.

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of the country; and whether it was from the old pastures of Cumnock, the forced Italian ryegrass at Cumming Park, or the heather of Corwar, the cheese was uniform in texture, quality, and flavour; if there was any sensible difference, our impression was that the best article was made at Corwar. Three of the cheeses, made at as many different places, were transferred to our own cheese room, and were it not for the private mark upon them, we could not have discovered them amongst our own"

TABLE

SPECIMEN TABLE FOR THE REGISTER OF OBSERVATIONS IN THE DAIRY.

Date of Observation.	Number of Cows.	Quantity of Milk.	Cream kept off.	Temperature of Milk when Rennet is put in	Chemical State of the Milk when Rennet is added.			Degree of Acidity.	State of the Rennet.				Time occupied in Coagulation.		Temperature of Curd when broken up.	Temperature to which the Curd is afterwards raised by Hot Whey.	Temperature of Curd when pressure is applied.	Interval betwixt the breaking of Curd and the forming of the Cheese.		Weight of Curd when Stoned.	Curd left over.	Curd added.	Quantity of Salt in Curd.	Quantity of Salt in Milk.	Quantity of Whey.	Acidity of the Whey	Quantity of Whey Butter.	Heat of Dairy-Room. 7 o'clock.	Heat of Dairy-Room. 11 o'clock.	Heat of Dairy-Room. 4 o'clock.	Time occupied in stoning the Cheese.	Weight of Cheese at subsequent periods.			Temperature of Cheese-room at 8 o'clock A.M.	General Remarks.
1857.		Gals.	Gills.	Deg.	Alkaline.	Neutral.	Acid.	Deg.	Fresh	Stale.	Clear	Turbid.	H.	M.	Deg.	Deg.	Deg.	H.	M.	Lb.	Lb.	Lb.	Oz.	Oz.	Gals.	Deg.	Lb.	Deg.	Deg.	Deg.	Days.	Lb.	Lb.	Lb.	Deg.	
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Appendix, No. I.

The old pastures of England are often referred to, as if Scotland was placed at hopeless disadvantage. There can be no question that milk from old pastures yields richer cheese, and more of it, than an equal quantity of milk from our young pastures; but it must be remembered that this is due much less to the age of the pastures, than to the different plants of which they are composed.

Old pastures are stocked with a great many genera and species of the most nutritious plants, and as every plant extracts from the soil and the atmosphere something peculiar to its kind, old pastures, it is clear, must present a far greater variety of stimulating and nutritive alimentary principles, and consequently a far more varied and generous food, than pastures composed of only a few varieties, such as our young ones can yield.

If to the plants, then, old pastures owe their richness, may not our young pastures be made as rich as any old ones? This would seem to depend on the seeds we sow.

In support of this supposition, the following list of plants, arranged according to their nutritive values—as determined by analytical research—may be adduced, as it will at least show that perennial ryegrass and white clover, the plants which form the principal part of our young pastures, stand very low in the scale:—

Scientific Names.	Common Names.	Nutritive Value.
Phleme pratense.	Timothy grass.	27.71.
Cynosurus cristatus.	Crested dogstail.	22.71.
Dactyles glomerata.	Cocksfoot.	17.58.
Lolium Italicum.	Italian ryegrass.	17.36.
Pod pratensis.	Smooth-stalked meadow grass.	16.56.
Festuca duriuscula.	Hard fescue.	16.16.
Trifolium pratense perenne.	Cow-grass.	15.71.
Holcus lanatus.	Yorkshire fog.	15.41.
Lolium perenne.	Perennial ryegrass.	15.38.
Medicago lupulina.	Yellow clover.	13.40.
Pod trivialis.	Rough-stalked meadow-grass.	13.12.
Trifolium pratense.	Common red clover.	12.72.
Trifolium repens.	White clover.	11.94.
. Festuca pratenses.	Meadow fescue, one of the best grasses, as well as other fescues, have been overlooked.	

If any doubt the accuracy of the above results, or desire further proof, they can appeal to the highest authorities in the matter—the cattle. Let them sow the cultivated natural and artificial grasses separately in a field, as the writer has done, and they will find that the cattle will eat most of the other grasses almost out of the ground before they will touch perennial ryegrass and white clover.

Many farmers, advancing with the progress made by the introduction of new grasses, have for long adopted a more enlightened

and liberal practice in sowing down; but the pastures generally yield only a scanty innutritious herbage, compared with what they are capable of producing.

Pasturing the soil with good plants is of equal importance with pasturing the grass with good stock. Though little advanced, pastures form an important branch of our present system of rural economy, and one so intimately connected with improvements in cheesemaking and dairy stock as to claim eminent attention.

To find out the grasses most relished by cattle, and the mixtures that assort and grow best, and are otherwise adapted to the ends in view, would form interesting subject for experiment and valuable acquisition to our knowledge.

To produce rich and productive pastures, we must anticipate nature by thoroughly stocking the land with a good variety of the best grasses, such as are palatable and nutritious; that resist drought, and grow at low temperatures; that are large growers, and spring quickly after being cropped. It is necessary to give a liberal allowance of seed, in order to prevent the growth of worthless and injurious indigenous plants; and owing to their gregarious habits, grasses plant closest and thrive best when in considerable variety.

Such a system of sowing down is more in accordance with the teachings of nature, which, in strewing the surface of the earth with a profuse variety of pasture-plants, meant to furnish to the herds and flocks nutriment fitted to replenish the waste and sustain the vigour of the animal functions.

For one year in grass the following can be recommended:—

Common ryegrass,	½ bushel.
Italian ryegrass, .	1 "
Yorkshire fog, .	2 "
Timothy grass, .	5 lb.
Red clover, .	8 "

Appendix, No. II.

As advantages resulting from an improved make and trade in cheese, it may be stated that prices would rule steadier and be more remunerating; consumers would have better value for their money; dairy cattle, of good milking quality, would be more sought after, and attention more earnestly turned to the improvement of their breed, the elements of which should be sought for in the source whence the Ayrshire breed of cattle sprung—the deep-milking Holderness, and the cream-giving Alderney (crosses from which often combine the excellences of both), or amongst some of the famed Continental dairy breeds, whence the Holderness was derived. And here opens a field of enterprise worthy the consideration of those wishing to do something for their day and generation. When there exist so much energy and desire for

improving our dairy breed, as expressed by the sums annually spent in premiums, it is somewhat strange we are so slow to profit by the example set us nearly a hundred years ago by our ancestors. When the few animals which they introduced originated (in a manner accidentally) such a breed as the Ayrshire, what might be done in the present day, with our knowledge of breeds and breeding, and the facilities of communication?

Existing dairies, likewise, would be increased, for which there is ample resource in our improvable pastures, and food that may be supplied in the stall; and this would lead to the conversion of the liquid refuse of the farm into herbage by means of Italian ryegrass, the luscious grass from which the celebrated Parmesan cheese is made, and also to the extended cultivation of the generous cabbage, which likewise rejoices in liquids.

Increased supplies of whey, again, would stimulate improvement in another important branch of rural economy, the breeding and feeding of pigs. The result, in short, would be a great increase in our material wealth, which would ramify through all the industrial interests of the country.

REPORT ON THE DRAINAGE OF HILL-FARMS.

By THOMAS LAWSON, Carlarach, Argyllshire

[Premium—The Medium Gold Medal]

THE drainage of sheep-farms in mountainous districts, embracing all kinds of soil, subsoils, and strata, acclivities of all degrees of swiftness, extensive tracts of table-land not unfrequently intervening at high elevations, and including that extraordinary production, a flow-moss, has always been a much-controverted subject; and from the absence of essays or recorded experiments, preceding generations have not done much to elucidate it. The most beneficial manner of ridding hill-pastures of the injurious excess of water, to which many of them are naturally subject, will always be much influenced by the quality of their soil, their elevation, and the climate in which they are situated. The humidity of the atmosphere on the western hills of Scotland renders a more severe drainage necessary on them than is required on the midland and eastern hills, where a drier air more generally prevails. Practice and observation are indispensable teachers in all operations connected with the improvement of the soil and its products; and in no branch is this more strikingly developed than in the drain-

age of the various formations that are met with on the hills of Scotland. Still, although there is considerable difference in these formations of hill-pastures, it is quite possible to lay down a few general rules that may be safely applied to effect a great improvement of pasturage, and be capable of adaptation to all varieties of soils and grasses, a due regard being paid to elevation and climate.

I consider that on hill-pastures it is desirable to allow the water-level to approach very near the surface, and that drains be only applied to remove an excess of water, with a careful regard to retain an ample supply of moisture for the continuous production of grasses. Experience has shown that on a hill-pasture a very high water-level may be preserved without danger of injury, provided the water be not allowed to be in quite a stagnant state; and in case of flow-mosses, nothing could be more injurious than an attempt to improve them by any great extraction of water. Such a state of moisture has the effect of keeping up a more equable temperature, in the winter months, to the roots of the grasses, as well as supplying nutriment to their blades. And as such a high water-level could not be retained by tile-drains, when placed sufficiently deep to avoid speedy closing up by the penetration of grass roots, it may be fairly assumed that surface-drainage is most generally suited for hill-pasture. The objects to be attained are, to create for the sheep an improved pasturage, pure water, and a healthy atmosphere, which would allow of their being kept in greater numbers, and enable them to attain to a larger size and higher condition.

Assuming that surface-drains are most adaptable for hill-pastures, the size of the drain that combines most efficiency in proportion to its cost, for ordinary purposes, is 24 inches wide at top and 6 inches wide at bottom, with a perpendicular depth of 16 inches. A lighter depth, on penetrable subsoils, would be liable to early closing by the growth of vegetable matter in the bottom; and a greater depth would render it difficult for a young lamb to get out, and would obstruct the necessary access of sheep to water, a liberal supply of which is advisable for all ruminating animals; and any increase of depth beyond 16 inches much increases the cost. They should be cut clean, the turf sod being placed 10 inches from the edge of the lower side of the drain, and the bottom clearings thrown beyond it; they will thus not be liable to be dragged into the drain. Direct-action drains (viz. those put in on the quickest descent) are most effective, and should be adopted on land of first quality: such land is generally indicated by the presence of Bullsnout (tufted-hair grass), Blue-point (tufted bog or blue sedge), Wild Scavy (devil's bit), Spart (blunt-flowered rush), and common rush; and any danger of such drains washing deep can be avoided by putting them in not more than 9 yards apart, and not running them extreme distances ere they are delivered

into main drains. The cost of such drainage is too great for poor or peaty surfaces producing little but Stool-bent (goose-corn), Deer-hair (marsh spiked rush), Wire-bent, and Flying-bent (blue-bent); but on such ranges, gentle declinating drains, at an angle that will allow a fall of 1 in 25, and placed 35 yards apart, may be applied with beneficial results. Flow-mosses abound in Drawling (hare's-tail cotton-grass), and are benefited by having drains put in not less than 60 yards apart. These mosses require a full surface water-level, and drains at that distance will not do more than carry off the excess, whilst they will much facilitate the entry of sheep on to them, increase their scope over them, and aid their easy return to their lairs when satiated. Those drains should commence from such parts as present a sort of highway entry from the other lands; and the proper placing of the drain-sods will be here found of great importance, forming a sort of elevated platform very useful as a sheep-track, particularly in cases of snow.

The important item of cost varies with the price of labour, and will range between 1d. and 2d. for seven yards, and generally be found at 1½d. for that length. A less definite opinion can be formed of their durability, as efficiently-cut drains will sometimes close in nine years, whilst on a favourable soil and subsoil they will remain unimpaired over twenty years. Thin soils, with rocky bottoms, grow up most quickly, and on clay subsoils their durability is extreme, and these are further effected by a slow or rapid descent. Main drains need not necessarily be either wider or deeper than ordinary ones, their principal object being to avoid washing, to carry water for irrigation purposes, or to discharge (without waste) excesses from a higher level into the natural channels and rivulets that always abound in mountainous districts.

The drainage of hill-pastures will always be largely influenced by the increased returns expected thereby, and should always be preceded by a careful examination of their elevation, climate, and the grasses they contain; and it will occasionally be found that one portion of a hill derives a largely-increased value from its proximity to another portion of a different description; and on account of a beneficial blending of pasturage, the wet portion may warrant a greater outlay, or even require less drainage, than where an equality of herbage prevails. In some places a single drain will be all that is necessary to free a considerable breadth of land placed at a lower level; arterial springs will, at their source, often form a shaking bog or quicksand, and these are best disposed of by putting in a deep close drain for a short distance; and where that is not practicable, the surface-drain can only be safely carried to the edge of the quicksand, as to break the turf without entirely removing the water from the broken soil

would really make a trap for drowning sheep. Some pastures have a local tendency to produce rot in sheep, and in such cases a deeper sinking of the water-level, although in a gradual manner, is more necessary than on pastures free from such an influence; and on good soils much addicted to rot, it is often advisable to put in tile-drains at a deep level. The description of stock to be kept, and method of farming, should always have due weight in draining, as ewes require a more moist pasturage than wedders. Some hill farms produce and sustain a continuous supply of grasses at all seasons for a full stock of sheep; others abound in very rich pasturage for the summer months, and afford but little winter keep; and a few hill-pastures, during many of the winter months, are so generally covered with snow that their drainage will properly be conducted with a view to the increased production of such grasses as are favourable for consumption during their accessible period.

Much of the drainage of hill-farms can be beneficially combined with the irrigation of such parts as suffer from too great a drainage by natural causes, except where pastures have any tendency to produce rot, as on such land irrigation would much increase that destructive disease. The water that will be found most valuable for irrigation purposes generally comes off a mossy soil or limestone strata Some springs that are highly impregnated with decomposed minerals are very injurious to grasses. The drainage of land both removes the water from the springs in the soil and lessens the atmospheric supplies. It is always desirable to ascertain from what cause the excess arises, and having ascertained how much of it owes its presence to arterial springs, to capillary attraction, and to atmospherie supply, regulate the drainage accordingly. The main-drains form the first step in actual operations, and except where a stratified foundation can be got, they may be put in with a gradient of one in thirty; the rule being, where drains are short, or the water supply small, swifter gradients are necessary, and longer runs may be safely used, and the greater the quantity of water to be taken away, the slower the gradient ought to be; and from these main-drains cut such branch drains as may seem warranted by the acclivities and herbage—always going in a straight line with direct-action drains; and in such as are at an angle, keeping as straight as is consistent with a proper level, although never neglecting to adopt, as far as safety will admit, any natural attempts the water may have made to relieve itself.

The following Table will show the cost per acre of surface-drains, exclusive of main-drains:—

Distance between Drains.	At 1d. per 7 yds.		At 1⅛d. per 7 yds.		At 1¼d. per 7 yds.		At 1⅜d. per 7 yds.		At 1½d. per 7 yds.		At 1⅝d. per 7 yds.		At 1¾d. per 7 yds.		At 1⅞d. per 7 yds.		At 2d. per 7 yds.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
At 6 yds. apart,	9	7¼	10	9⅝	12	0	13	2⅝	14	4⅞	15	7¼	16	9⅝	18	0	19	2½
7 ...	8	2¾	9	3	10	3¼	11	3½	12	4⅛	13	4⅜	14	4⅝	15	4⅞	16	5½
8 ..	7	2¼	8	1	8	11¾	9	10½	10	9⅜	11	8⅛	12	6⅞	13	5⅝	14	4½
9 ...	6	4¾	7	2¼	7	11⅞	8	9⅜	9	7⅛	10	4⅝	11	2¼	11	11⅞	12	9½
10 ...	5	9⅛	6	5½	7	2⅜	7	11¼	8	7⅝	9	4	10	0⅞	10	9¼	11	6¼
12 ...	4	9⅝	5	4¾	6	0	6	7⅛	7	2⅛	7	9½	8	4¾	8	11⅞	9	7⅛
15 ...	3	10	4	3¾	4	10½	5	3¼	5	10	6	2¾	6	8½	7	2¼	7	8⅛
20 ...	2	10½	3	2¾	3	7⅛	3	11⅜	4	3¾	4	8	5	0⅜	5	4⅝	5	9
25 ...	2	3⅝	2	7	2	9½	3	1⅞	3	5⅜	3	8¾	4	0¼	4	3⅝	4	7¼
30 ..	1	11	2	1½	2	4¾	2	7⅝	2	10½	3	1⅝	3	4¼	3	7⅛	3	10
35 ...	1	7¾	1	10¼	2	0⅝	2	3	2	5⅝	2	8	2	10½	3	0⅞	3	3½
40 ...	1	5¼	1	7⅜	1	9⅜	1	11⅜	2	1⅝	2	3⅝	2	5¾	2	7¾	2	10½
45 ..	1	3⅜	1	5¼	1	7⅛	1	9	1	11	2	0⅞	2	2¾	2	4⅝	2	6¾
50 ...	1	1¾	1	3⅝	1	5⅛	1	6¾	1	8⅝	1	10¼	2	0	2	1⅝	2	3½
55 ...	1	0½	1	2	1	3⅝	1	5¼	1	6¾	1	8⅜	1	9⅞	1	11½	2	1
60 ..	0	11½	1	0⅜	1	2¾	1	3¼	1	5¼	1	6⅝	1	8⅛	1	9½	1	11

Some parts of hill-pastures are so much injured by an excess of water that the improvement of the herbage by draining will not be less than 500 per cent on the annual value, and to that must be added the contingent benefits of increased purity of water and an improved atmosphere; and by efficient drainage the stagnant water is removed that forms a breeding nursery for many insects that annoy and injure sheep stock. Drains on the direct-action principle will generally remain efficient for sixteen years, the herbage attaining its full benefits by the fourth year, and continuing unimpaired so long as the drains are kept in an active state. Drains on the declinating angle principle may be expected to remain efficient for ten years. Drains on a "flow-moss" will remain perfect for twenty years. The increased value of the herbage on such mosses will be slight, the accruing benefits being the increased access to and from such eccentric but useful additions to hill-pastures. In all cases of drainage I have found a continuous accession of drains more useful than what is called a full course of drains put in at distant intervals; and land that has been once drained on a proper principle should never be allowed to retrograde, it being always much easier to retain a good herbage than to renew it when injured. A gradual drainage is safest, as it enables the operator to attain the proper water-level, and thereby avoid possible injury by over-drainage. The general health of sheep is much promoted by keeping their pasture judiciously drained; they will be maintained in a more uniform condition, their size will be increased, and their wool will be improved in quality, although it may not be increased in quantity. The main source from whence the reimbursement may be expected is in the increased number of sheep that drainage enables a hill-pasture to

efficiently maintain; and although there will be great extremes in the improved value of the pastures, yet the ordinary return may be fairly estimated at from 25 to 35 per cent on the outlay of the draining costs as soon as the new class of grasses created by the drainage have obtained possession of the soil; and by a continuous drainage a large net increase in the annual returns may be permanently established. The greatest benefits will be acquired in a humid climate. Water is one of our greatest fertilisers, and its secretion on hill-pastures is a very valuable natural irrigation, and requires only a trifling aid from science to be converted into a most useful adjunct for increasing the quantity and improving the quality of grasses on mountain-pastures.

PROCEEDINGS IN THE LABORATORY

By Professor ANDERSON, M.D., Chemist to the Society.

I.—ON THE COMPOSITION AND VALUE OF FISH-MANURE.

SOME years since, public attention was directed to the large quantities of fish unsuited for human food, and of offal collected at the large fish-curing establishments existing in various parts of the coast. The good effects obtained by their application as manure by farmers in the neighbourhood, suggested the importance of converting them into a portable form, so as to insure the use of that large proportion for which there existed no demand in their natural state; and it was pointed out that if this could be done, the supply of refuse fish might be greatly increased, it being at present a common practice among fishermen to throw into the sea all the inedible fish, whereas if a demand existed for them, they would all be brought to shore. The result of this suggestion was, that a large number of patents for methods of treating fish and offal were taken; but few, if any, of them have come into operation on the large scale; and, at all events, the manufacture has attained no extension, and the prospects of an abundant supply of manure from this source are at the present moment as distant as ever. The principal cause of this result appears to be the too great complexity of the methods of manufacture which were suggested, and which required, in many instances, expensive and complicated machinery, or too costly materials. The former of these is a difficulty of the most serious character, because there are few, if any, places where the supply of fish is sufficiently large to enable expensive machinery to be worked with profit; and the irregularity of the supply, and the total cessation of fishing, during a considerable part of the year, render it

impossible to carry on the works with that regularity which is the soul of all manufacturing processes in which machinery is employed.

As a necessary consequence of these expensive processes, the cost of the manure produced was excessive; and farmers, contrasting it with guano and other manufactured manures, and finding that they were materially cheaper, naturally evinced a preference for those which they had been accustomed to use, and refused to give a price which would remunerate the manufacturer.

The failure of these processes, however, should not lead to the conclusion that it is impossible to convert fish into a dry manure, but should rather direct attention to the contrivance of simpler and easier processes. The truth is, that there has been a great deal of misunderstanding as to what is required to make such substances portable. The manufacturers of manures are rarely familiar with the principles of the art they practise, and being strongly impressed with the importance of rendering manures soluble, have most commonly made treatment with sulphuric acid in some way or other a fundamental part of their process; whereas, in this case, at least, all that is requisite is to remove the water, and to reduce the dry residue to a pulverulent state. To effect this object, no complicated apparatus is necessary, all that is required being a stove or flat drying surface, heated either by a small furnace, with flues passing backwards and forwards, or by means of steam, the latter being preferable. A thin layer of the moist fish or offal being laid upon this, might be rapidly dried and converted into a proper state before putrefaction commenced, and a manure be produced which would have comparatively little smell. As regards its value, there is some difficulty in forming an opinion; but some guide may be afforded by reference to the composition of such manures of this kind as have appeared in the market, analyses of several of which have at different times been made in the laboratory. The first of them to which I shall refer are two samples made on the east coast of England, by a process, with the nature of which I am unacquainted. They were found to contain:—

	I.	II.
Water,	9.77	12.15
Organic matter,	53.55	55.27
Phosphates,	4.72	6.44
Sulphate of lime,	1.63	1.71
Common salt,	26 49	22.29
Sand,	3.84	2.14
	100.00	100.00
Ammonia,	6.20	7.63

If we estimate these according to the plan used for guanos, then No. I. is worth about £4, 12s., and No. II., £5, 10s. per ton,—values which are certainly not very high. We must take into account, however, the large quantity of common salt, which materially reduces the value; and if it were possible to exclude this substance,

which we shall immediately see can be done, then the value of these samples would be about £5, 15s., and £6, 18s. respectively.

Another sample, the source of which I have been unable to ascertain, but which I believe to have been offered for sale in Liverpool, contained:—

Water,	7.55
Organic matter,	87 45
Phosphates,	0.55
Carbonate of lime,	0.45
Alkaline salts,	2 55
Sand,	1.45
	100.00
Ammonia,	7.29

The absence of common salt in this case, except to a very small extent in the alkaline salts, shows the possibility of producing a manure without that substance; but in this case the value is somewhat lower, owing to the trifling proportion of phosphates. It does not exceed £4, 16s. per ton. It is probable that in this case some charcoal or other organic matter had been mixed with the fish, with the view of its acting as an antiseptic during the process of manufacture; but on this point I am unable to speak positively.

The last sample to which I shall refer was manufactured on the Portuguese coast, whence it was imported into this country. It is of a totally different nature from the others, sulphuric acid having obviously been used to some extent in the process, and sulphate of lime apparently added as a drier. For this reason its value must be estimated on the same principle as that of a superphosphate, which, indeed, it somewhat resembles in composition.

Water,	14.04
Organic matter,	27.77
Biphosphate of lime equivalent to 7.00 bone-earth made soluble,	4.48
Insoluble phosphates,	1.60
Sulphate of lime,	36.17
Alkaline salts,	6.14
Sand,	9.80
	100.00
Ammonia,	2.10

This manure is worth only £3, 16s. per ton, and this value is chiefly derived from the biphosphate of lime it contains.

Fish-manures have usually been offered for sale at from £8 to £9 per ton; and at this price there is obviously no inducement to buy them, and hence the failure of the manufacture. But it is still a question whether, setting aside all complex processes, and simply confining the process to drying the fish and offal, it might not be possible to produce a manure which could be sold at a price sufficiently low to create a demand. The point on which this must mainly depend, is the price at which the raw material can be ob-

tained. At present we believe fish-refuse may be got for 8s. or 10s. per ton; and as it will require four or five tons to make one ton of manure, the raw material may be taken to cost about £2 per ton; and allowing the same sum for the cost of manufacture, the price at the works would be £4 per ton, which would be increased, by retailer's profit, &c., to £6 when it came into the hands of the farmer. This price would exceed the value of any of the samples of which the analyses have been given above; but then it is probable that the quality of the manure would also greatly exceed any of them; in fact, if properly manufactured, it can scarcely be doubted that a manure fully equal to that value might be produced. It is extremely desirable, for the interests of agriculture, that some trial should be made, so as to ascertain whether it be practicable to produce such a manure with profit. One thing, however, is certain, that if it is to be done at all, it ought not to be taken up as a separate branch of manufacture, but should be carried out by the fish-curers, who ought to convert their own refuse into manure. Any other plan, involving, as it must necessarily do, considerable cost in transporting the raw material from one place to another, is not likely to succeed. On the coast of Scotland, there are many places where abundance of fish is to be obtained; and it is much to be desired that some enterprising persons could be found to make a trial of this manufacture.

II.—ON THE COMPOSITION OF A MANURE FOUND IN CAVES FREQUENTED BY BATS.

I have lately had occasion to examine a sample of a manure produced by bats, and which may, in fact, be considered as a new kind of guano. It is found in caves in some of the West Indian Islands, and is in the form of an exceedingly light and bulky brown powder, consisting in part of small crystalline scales, and is almost devoid of smell. Its analysis, made in the usual manner adopted for guano, gave the following results:—

Water,	13 66
Organic matter and ammoniacal salts,	64.12
Phosphates,	15.14
Carbonate of lime,	6.28
Alkaline salts,	Traces
Sand,	1.40
	100.00
Ammonia,	9.55

I have no information regarding the extent of the deposits of this substance, but, in the present dearth of ammoniacal manures, it deserves notice, from its containing a larger quantity of ammonia than any manure at present in the market, except Peruvian guano.

Its calculated value is sufficient to make it of importance, and to induce an attempt being made to import it into this country; it is, in fact, worth about £7 per ton,—a price amply sufficient to remunerate the importers. The only difficulty lies in its bulky nature, which would probably be objectionable, although it is probable that the sample I received may be lighter than it is in its natural condition.

III.—ON SOME KINDS OF LINSEED CAKE AT PRESENT IN THE MARKET.

Some years since, I published in the Transactions of the Society an extensive series of analyses of oil-cakes from different localities, the results of which led me to the conclusion that the variations in its quality were by no means great, and that the farmer was pretty sure in all cases to obtain a genuine article. For a considerable period after the publication of that paper, my opinion remained unchanged; but within the last year or two I have had occasion to examine several samples of adulterated oil-cake, and a notice of a remarkable instance in which a large quantity of grass-seeds were found in a cake, appears in the last volume of the Transactions. During the past year I have analysed several samples of cake, which present a remarkable deficiency in the proportion of albuminous matters. In the paper already referred to I stated that good oil-cake usually contains from 4 to 4.5 per cent of nitrogen, corresponding to from 25 to 28 per cent of albuminous compounds, and 10 or 12 of oil; and Mr Way arrived at similar results from his analyses. The extent of deviation from these limits was always extremely small; but at present, numerous samples of oil-cake are met with which are materially under this standard, as exemplified by the following analyses:—

	I.	II.	III.
Water,	5.65	11.21	12.20
Oil,	10.72	8.68	10.22
Albuminous compounds,	19.31	21.44	20.95
Starch, gum, &c.,	45.97	40.92	39.48
Fibre,	11.25	8.00	7.65
Ash,	7.10	9.75	9.50
	100.00	100.00	100.00
Nitrogen,	3.09	3.43	3.34

In these cases the albuminous compounds are 5 or 6 per cent under the proportion usually found in good cake, and this is accompanied also by a rather low per-centage of oil. On examining these samples, nothing particular was observable; they were all well pressed, and uniform in appearance, and the eye was unable to detect any foreign seeds which might have been mixed with the linseed. In No. 3, it is true, the quantity of small black seeds, so often seen in oil-cake, was large; but still not so great as to lead to the conclusion that the low per-centage of nitrogen

was due to them. At the same time, it was undoubtedly an inferior cake, and had produced intestinal irritation in the animals to which it had been given. Nos. 1 and 2, however, to the eye were in every respect satisfactory, and appeared to be free from any admixture of impurities. It is difficult to ascertain the causes of this peculiarity of composition; but it is obviously not due to admixture of any other oily seed; for all of those likely to be used, such as rape, poppy, and the like, contain as large a proportion of albuminous matters as linseed; and it must be done by mixing with it some substance poor in nitrogen, previous to expression, and the substance, whatever it may, must have been very carefully mixed with the oil-seed. I have heard it stated that the addition of some substances to the linseed facilitates the expression and increases the yield of oil; but this appears very doubtful, and certainly cannot have been the object in Nos. 1 and 3, where the oil is but little under the average quantity contained in ordinary oil-cake. In No. 2, where the expression has obviously been very complete, the oil being decidedly under the average, we have the conditions favourable to the highest percentage of nitrogenous matter, and it is probable that some foreign matter has been added.

In one instance in which samples of cake were sent to the laboratory for analysis, the inferiority was even more marked than in any of the preceding cases. Two cakes, taken from different parts of the same cargo, were found to differ materially in appearance, one being much darker than the other; but, as far as their general appearance, firmness, and neatness of shape were concerned, there could be little exception taken to them. One of these cakes contained—

Water,	10.53
Oil,	5.03
Albuminous matters,	19.56
Starch, gum, &c.,	51 41
Fibre,	8.02
Ash,	5.45
	100.00
Nitrogen,	3.13

A complete analysis was not made of the other cake, but the percentage of albuminous compounds and ash was determined, with the following results :—

Albuminous compounds,	16 31
Ash,	9.62
Nitrogen,	2.61

Although the external appearance of these cakes was satisfactory, the careful examination of its interior, when carefully broken and split up in different directions, showed the presence of a number

of other seeds, and of fragments of fibre of the flax, and its inferiority was completely confirmed. It is difficult, however, to say whether, in this case, a deliberate adulteration had been practised or not; for it is almost impossible to draw the line between that and carelessness in the preparation of the seed. In fact, slovenly cultivation of the crop grown for seed is no doubt often the cause of an inferiority which might be avoided with a very little care. I have been anxious to advert to this subject at present, because at no distant date I stated that adulterated and inferior oil-cakes were rare; a statement which I believe to have been correct at the time it was made, but which is so no longer; and it behoves feeders to be cautious in their purchases of cake, and to select only that which is of the best quality, and of which the purity can be guaranteed.

IV.—NOTE ON SOME ADULTERATED MANURES.

I am induced to direct attention at the present moment to the adulteration of manures, because I am satisfied that, notwithstanding the many warnings which farmers have received as to the necessity of care in making their purchases, the extent to which adulterated and inferior manures are sold is increasing rather than diminishing. The facility with which chemistry detects the inferiority of a manure would, if it were more widely made use of, soon extinguish adulteration; but the unwary purchaser too often allows himself to be misled by the specious promises of dealers who assure him that analysis is unnecessary, as he can guarantee the quality of the article he sells. Scarcely a week passes in which manures sold in this way are not brought to the laboratory, in regard to which suspicion has been excited long after the manure has been used and paid for, and when redress cannot be obtained except by having recourse to a long expensive and uncertain lawsuit—the risk of which too often protects the adulterator from punishment.

The carelessness of purchasers is conspicuously seen in the extent to which adulterated Peruvian guano is still sold; for although it is well known that it can be obtained genuine from one source only, and the seller can always prove to the buyer that what he sells is derived from that source, great quantities of guano are sold as genuine Peruvian, or under the more cautious title of *Indirect* Peruvian, which are grossly adulterated. I subjoin a few analyses of samples sold during the present season as Peruvian guano; not that they present any novelty, for the adulterations are all of the same kind that have been in use for many years back, but merely to show their great inferiority and the immense loss thus entailed on the farmer. In fact, several of those samples

were sold at the full price of the genuine article; and when the price was lower the difference was always very trifling:—

	I.	II.	III.	IV.	V.
Water, ...	12.30	13.55	9.86	9.95	8.90
Organic matter and ammoniacal salts,	16 93	25.01	41.92	23.43	20.10
Phosphates, ...	13.34	26.50	18.18	16.50	12 05
Sulphate of lime, . . .	7.68	19.84	2.11	6.88	...
Carbonate of lime, . . .	7.83	...	...	...	...
Alkaline salts, ...	2.36	4.73	6.71	2.56	6.15
Sand, ...	39.56	10.37	21.22	40.68	44.55
	100.00	100.00	100.00	100.00	100.00
Ammonia, ...	4.49	5.90	13.26	6.68	6.08

The average value of these samples is under £6 per ton, so that the amount of money lost by the farmers must be very large. From what has come under my notice, I feel satisfied that several thousand tons of such guano are annually sold in Scotland, but a small proportion of which is detected.

Inferior superphosphates are also extremely common. They are made, for the most part, from inferior materials, with an insufficient supply of acid. A few examples of articles sold during the last few months will show the necessity of caution in regard to it also—

	I.	II.	III.
Water, ...	9.31	21.60	13.08
Organic matter, ...	9.89	11.62	6.21
Phosphate of lime, ...	2.27	2.98	1.06
Equivalent to bone-earth made soluble, .	(3.55)	(4.65)	(1.65)
Insoluble phosphates, . . .	17.40	25.70	5.80
Sulphate of lime, ...	53.97	23.66	13.29
Alkaline salts, ...	1.91	10.70	2.31
Sand, ...	5.25	3.80	58.25
	100.00	100.00	100.00
Ammonia, ...	0.77	1.32	0.35

I have here selected three very bad samples, but between them and genuine superphosphates containing 12 or 13 per cent of biphosphate ot lime, equivalent to 18 or 20 of soluble phosphates, many others might be given. Enough has been done, however, to show that adulteration is abundant in this manure as well as in guano. It is remarkable how few cases occur in which the adulterators of manures are brought to punishment, and one reason I believe is, that whenever they see that a case can be made up against them, they come to terms with the purchaser; and though in this way they must frequently make a loss, the large profit derived from adulteration, when it is undetected, must still make it a highly remunerative business.

LIST OF PLOUGHING COMPETITIONS *reported to the Society in* 1858-1859.

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
ABERDEENSHIRE—						
Balus, Longside	28 Dec. 1858	52	1 rood 15 poles	$3\frac{1}{2}$ hours	£4 15 6	Cumming Daniel, farm-servant, Strichen.
Cullerley	2 Dec. 1858	41	$\frac{1}{3}$ acre	$4\frac{1}{3}$ hours	3 8 0	William Smith, farm-servant, Cullerley.
Culqubannie	24 Dec. 1858	33	$\frac{1}{3}$ acre	4 hours	3 12 0	James Forbes, farmer, Tombreck.
Mains of Drumminor ...	28 Dec. 1858	46	$\frac{1}{3}$ acre	$4\frac{1}{2}$ hours	4 4 0	David Murrian, farm-servant, Cairndaird.
Little Banchory	18 Jan. 1859	22	$\frac{1}{2}$ acre	5 hours	4 10 6	William Walker, farm-servant, Tillyhows.
Perwinnes	15 Dec. 1858	34	1 rood 12 poles	5 hours	6 16 0	Joseph Henry, farm-servant, Scotstown.
Skillymains	23 Dec. 1858	37	1 rood 5 poles	3 hrs. 42 m.	3 0 0	Geo. Murray, farm-serv., Mains of Kindrought.
Whitemyres	16 Dec. 1858	32	$\frac{1}{3}$ acre imperial	$3\frac{1}{2}$ hours	5 0 0	David Watson, farm-serv., West Huxterstone.
Nethermuir	17 Dec. 1858	35	$\frac{1}{3}$ acre Scotch	4 hours	3 13 6	A. Mitchell, farmer, W. Auchquchadlie, New Deer.
ARGYLLSHIRE—						
Auchinreir	10 Mar. 1859	16	1 rood 20 poles	4 hours	3 0 0	Alexander M'Arthur, Barcaldine Mill.
Ballimore	3 Feb. 1859	21	$\frac{1}{2}$ acre	$4\frac{1}{2}$ hours	3 16 0	Neill M'Lachlan, farm-servant, Ballimore.
Clenmackrie	25 Feb. 1859	17	1 rood	4 hours	3 0 0	Dugald Cowan, farmer, Gylen.
Clochkeel	28 Jan. 1859	30	1 rood $27\frac{1}{2}$ poles	5 hours	4 7 6	John M'Callum, Darlochan.
Corryghail	18 Mar. 1859	15	$\frac{1}{2}$ acre	5 hours	3 3 0	Gilbert Carmichael, Glenorchy Manse.
Duart	2 Mar. 1859	15	$\frac{1}{2}$ acre	6 hours	3 1 0	Lachlan Campbell, Duart.
Gortanaisaig	25 Jan. 1859	15	1 rood 30 pls. Sc.	$5\frac{1}{2}$ hours	4 0 0	Robert Curry, Killellan.
Inveraray	25 Feb. 1859	22	$\frac{1}{2}$ acre	6 hours	3 3 0	Archibald M'Dougall, farmer, Callevraid.
Maymore	20 Feb. 1859	17	$\frac{5}{8}$ acre	$6\frac{1}{2}$ hours	4 7 0	Peter Weir, Auchatigain.
Rosehill	1 Mar. 1859	19	1 rood 20 poles	$4\frac{1}{2}$ hours	3 3 0	Edward M'Geachy, Ballivain.
AYRSHIRE—						
Boydstone	18 Feb. 1859	50	Rate of 1 acre	12 hours	4 3 0	Hugh Millar, Stairley.
Carcluie	15 Jan. 1859	17	Rate of 1 acre	16 hours	5 5 6	David Wright, farmer, South Corton.
Carngillan	29 Jan. 1859	38	Rate of 1 acre Sc.	14 hours	3 3 0	John Gray, Mossidie.
Clincaird Mains	22 Jan. 1859	39	1 rood 6 poles Sc.	$4\frac{3}{4}$ hours	3 0 0	Andrew M'Garva, Altuine.
Craigneil	28 Jan. 1859	44	Rate of 1 acre	10 hours	3 8 0	Gilbert Logan, farm-servant, Pinwherry.
Dykescroft	10 Feb 1859	21	1 rood 18 poles	$5\frac{1}{4}$ hours	3 4 0	David Blakely, farm-servant, Mains.
Highlongmuir	10 Feb. 1859	20	1 rood 16 poles	5 hrs. 36 m.	3 1 6	Hugh Robertson, Holehouse, Dunlop
High Thornyflat	27 Jan. 1859	16	1 rood 26 poles	6 hours	4 0 0	Thomas Lindsay, Townend, Craigie.
High Todhill	8 Feb. 1859	21	1 rd. $16\frac{1}{2}$ pls. Sc.	3 hrs. 39 m.	4 15 0	William Lindsay, farm-servant, Gardrum.
Knockshinnock	5 Jan. 1859	25	1 rd. 10 pls. Sc.	5 hours	3 7 6	John Montgomerie, farmer, Tarelgin.
Knockterra	13 Jan. 1859	35	1 rood	4 hours	4 8 6	John Terbet, farm-servant, Pennyfadzeoch.
Onthank	4 Feb. 1859	36	36 poles	3 hrs. 36 m.	4 11 6	Robert Smith, Fort Acres, Dundonald.
Walton	20 Jan. 1859	25	Rate of 1 acre Sc.	16 hours	4 6 0	Hugh Donald, farm-servant, Ballochmyle.
Warrix	23 Feb. 1859	24	1 acre Scotch	16 hours	3 10 0	Chas. Hamilton, farm-ser., Eglinton Iron-Works.
Waterside	15 Feb. 1859	25	$\frac{1}{2}$ acre	6 hours	3 0 0	Gilbert M'Call, farm-servant, Maxwood.
West Heads	18 Feb. 1859	21	$1\frac{1}{5}$ rood	$4\frac{1}{2}$ hours	5 10 0	Thomas Lindsay, Woodhead, Loudoun.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
BANFFSHIRE—						
Cushnie	31 Dec. 1858	31	$\frac{1}{3}$ acre	$3\frac{1}{2}$ hours	£4 1 0	James Ross, farm-servant, Balmaud.
Inverlochy	24 Feb. 1859	15	$\frac{1}{2}$ acre	5 hours	3 4 0	John Grant, farm-servant, Campdellmore.
BERWICKSHIRE—						
Ayton law	29 Dec. 1858	24	$\frac{3}{4}$ acre	6 hours	5 7 6	Thomas Braidford, farm-servant, Billiemains.
Dods, Legerwood	25 Dec. 1858	31	$\frac{1}{2}$ acre	5 hours	4 8 0	Robert Shiel, farm-servant, Spottiswoode.
Hutton Mains	17 Dec. 1858	21	$\frac{3}{4}$ acre	7 hours	5 7 6	George Carr, Fishwick.
Langrigg	22 Dec. 1858	22	$\frac{3}{4}$ acre	6 hours	5 7 6	John Hume, Whitsomehill.
Eccles	21 Dec. 1858	22	$\frac{3}{4}$ acre	$7\frac{1}{2}$ hours	4 2 6	John Wilson, farm-servant, Wormerlaw.
Middlestots	19 Jan. 1859	29	$\frac{3}{4}$ acre	6 hours	3 11 6	Walter Patterson, Middlestots.
Rigfoot	19 Feb. 1859	18	Rate of 1 acre	10 hours	3 0 0	Robert Goodall, farm-servant, Cranshaws.
Rules Mains	23 Dec. 1858	26	$\frac{3}{4}$ acre	7 hours	6 12 6	John Cockburn, Chapel.
BUTE—						
St Colmac	8 Feb. 1859	47	1 acre Scotch	16 hours	7 6 0	William Morrison, Grenach.
CAITHNESS-SHIRE—						
Brawl	19 Jan. 1859	36	2 roods 18 poles	6 hours	3 15 0	John Sutherland, farm-servant, Greselittle.
Latheron	16 Feb. 1859	29	$\frac{1}{2}$ acre	5 hours	3 17 6	David Coghill, farm-servant, Reisgill.
CLACKMANNANSHIRE—						
Gra-smainston	13 Dec. 1858	18	$\frac{3}{4}$ acre	7 hours	3 3 0	John Mercer, farm-servant, Broomhill.
Manorneuk	28 Dec. 1858	29	Rate of 1 acre Sc.	14 to 16 hrs.	3 17 0	James M'Leay, Manorneuk.
DUMBARTONSHIRE—						
Muirside	27 Jan. 1859	19	$\frac{1}{2}$ acre Scotch	$7\frac{1}{4}$ hours	3 15 0	Alexander M'Callum, farm-servant, Meiklehill.
Third—Kilmaronock	11 Jan. 1859	25			6 19 0	John Bilsland, Spittal, Kilmaronock.
DUMFRIESSHIRE—						
Buckurrdlees	1 Feb. 1859	20	2 roods imperial	5 hours	7 5 0	James Marshall, farm servant, Glencartholm.
EDINBURGHSHIRE—						
Howden	24 Dec. 1858	43	$\frac{1}{2}$ acre Scotch	$7\frac{1}{2}$ hours	7 0 0	Peter Gray, farm-servant, Langton.
Redside	28 Dec. 1858	22	$\frac{1}{2}$ acre imperial	5 hours	4 9 0	James Richardson, farm-servant, Aikendean.
Shewington, Whitehill, ...	24 Dec. 1858	22	$\frac{1}{2}$ acre imperial	5 hours	4 11 0	Archibald Shearer, farm-servant, Brochrig.
Wester Middleton	14 Dec. 1858	39	$\frac{1}{2}$ acre imperial	5 hours	4 9 0	John Wilson, farm-servant, Arniston.
Yorkston	21 Dec. 1858	40	$\frac{6}{10}$ acre imperial	6 hours	3 11 6	Alexander Hill, farm-servant, Rosebery.
Dalkeith Park Home Farm ...	15 Jan. 1859	27	$\frac{3}{4}$ acre imperial	$7\frac{1}{2}$ hours	3 10 6	Thomas Kerr, farm-servant, Crookston.
D'Arcy	7 Jan. 1859	29	$\frac{1}{2}$ acre	5 hours	3 10 0	George Rutherford, Lingerwood.
Hilltown	28 Jan. 1859	18	$\frac{1}{2}$ acre	$7\frac{1}{2}$ hours	3 3 0	William Hunter, farm-servant, Cauldcoats.
Monktonhall	29 Jan. 1859	36	$\frac{1}{2}$ acre Scotch	7 hours	3 16 6	Thomas Kerr, farm-servant, Crookston.
South Gyle	11 Jan. 1859	39	$\frac{1}{2}$ acre Scotch	$7\frac{1}{2}$ hours	5 15 0	John Samuel, farm-servant, Cocklaw.

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
Fifeshire—						
Baldridge Fore Bank	24 Dec. 1858	34	½ acre	7 hours	£4 10 0	Robert Toshack, farm-servant, Dunduff.
Berryside	24 Dec. 1858	24	½ acre Scotch	6½ hours	3 5 6	James Beveridge, Lahill Craig.
Calais	17 Dec. 1858	38	½ acre	5 hours	3 15 0	David Adamson, Cattlehill.
Clunie Mains	24 Dec. 1858	26	½ acre Scotch	6½ hours	3 18 0	Thomas Galloway, farm-servant, Bogie.
Farmlands	22 Dec. 1858	24	½ acre Scotch	6 hours	3 16 0	Robert Galloway, farm-servant, Walkerton.
Kenly	21 Jan. 1859	38	½ acre Scotch	5 hours	4 18 0	James Leslie, Camgour.
Myregornie	7 Jan. 1859	26	½ acre	5 hours	3 7 6	James Black, farm-servant, Mitchelston.
Forfarshire—						
Brechin Castle	12 Jan. 1859	32	½ acre	6 hours	4 0 0	John Jaffray, Broomfield.
Kinalty, Cortachy	18 Dec. 1858	32	½ acre	5 hours	3 0 0	Charles Stewart, Wester Memus.
Newmill of Craigessie ...	23 Dec. 1858	31	½ acre	5½ hours	3 10 0	Alexander Reid, Miltonbank.
Nether Tulloes	30 Dec. 1858	48	½ acre	5 hours	8 5 0	Alexander Reid, Seggieden.
Haddingtonshire—						
Neuk	23 Dec. 1858	17	½ acre	5 hours	4 3 6	William Slight, farm-servant, Neuk.
Inverness-shire—						
Balmacuan	10 Feb. 1859	20	1½ acres	4½ hours	6 0 0	Peter Gordon, farm-servant, Shewglie.
Barnyards	17 Feb. 1859	45	½ acre	5 hours	4 10 0	Roderick Gordon, Moniack.
Upper Muckovie	23 Feb. 1859	47	½ acre	5 hours	4 15 0	Donald Henderson, farm-servant, Kingsmills.
Kincardineshire—						
Nether Balfour of Durris ...	15 Dec. 1858	41	Rate of 1 acre	10 hours	5 10 6	Charles M'Hardy, Cairnfauld.
South Hirn, Banchory Ternan	16 Dec. 1858	28	1 rood 8 poles	3 hours	3 8 0	William Taylor, North Hirn.
Wester Auquhallie	24 Dec. 1858	20	Rate of 1 acre	10 hours	5 12 6	John Caird, jun., Newbigging of Rickarton.
West Monduff	21 Dec. 1858	23	1 rood 5 poles	5 hours	6 10 6	James Ross, farm-servant, Jellybrands.
Craighead of Badentoy ...	11 Jan. 1859	32	½ acre	5 hours	7 2 6	John Knowles, farmer, Findon.
Strachan	27 Jan. 1859	22	2 roods	5 hours	6 1 0	Alexander Webster, farm-servant, Gateside.
Kinross-shire—						
Rossie	24 Dec. 1858	35	½ acre Scotch	6 hours	3 18 0	James Glass, farm-servant, Gospetry.
Turfhills	24 Dec. 1858	45	½ acre	5 hours	3 0 0	James Hepburn, Marybrough.
Kirkcudbright—						
Low Hardland	28 Jan. 1859	30	1 rood	3½ hours	4 12 0	David Tait, Gateside, Balmaclellan.
Lanarkshire—						
Barmulloch	25 Jan. 1859	36	2 roods	7 hours	9 2 6	Alexander Gilchrist, Park.
East Rogerton	25 Jan. 1859	34	Rate of 1 acre Sc.	17 hours	9 5 6	John Morrison, Milton.
Rochsilloch	13 Jan. 1859	28	2 roods 6 poles	7⅛ hours	7 7 6	Archibald Cullen, Kippsbyre.
Ryeflat	5 Feb. 1859	16	2 roods 20 poles	7½ hours	4 10 0	James Loudon, farm-servant, Netherton.
Orkney—						
Kierfield	25 Jan. 1859	25	½ acre	5 hours	3 9 0	James Crystle, Sunnyside, St Ola.
Strathore	1 Feb. 1859	22	2½ roods	5 hours	3 5 0	Henry Nicolson, Hannatoft.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
PEEBLESSHIRE—						
Haswellsykes	17 Dec. 1858	17	2 roods 15 poles	6 hours	£3 17 0	David Inglis, Barns.
Jedderfield	10 Dec. 1858	18	1 acre	10 hours	4 0 0	Alexander Thom, Chapelhill.
PERTHSHIRE—						
Ardittie	3 Mar. 1859	16	½ acre	5 hours	3 6 0	James Russel, farmer, Frenchtown.
Balbeggie	6 Jan. 1859	23	⅓ acre Scotch	5 hours	4 14 0	James Scott, South Gairdrum.
Belhie	19 Jan. 1859	17	½ acre	5 hours	3 0 0	James M'Donald, farm-servant, Kirkton.
Caldees	14 Jan. 1859	18	1 rood 25 poles	6 hrs. 8 min.	4 3 0	Thomas Marshall, Templemill.
Edradour	21 Feb. 1859	20	½ acre	6 hours	3 6 6	Alexander Campbell, Tomantarich.
Fotheringham	9 Dec. 1858	53	½ acre	5 hours	7 4 0	William Paterson, farm-servant, Hatton.
Inchture	29 Jan. 1859	41	½ acre	6 hours	3 0 0	William Anderson, Ballindean.
Lintrose	15 Feb. 1859	20	2 roods 20 poles	6 hours	3 0 0	David Adam, farm-servant, Hillfoot.
Lochlane	25 Feb. 1859	25	½ acre	7 hours	4 5 6	William Stewart, farm-servant, Alickmore.
Mid Frew	11 Jan. 1859	22	1 rood 30 poles	5½ hours	3 10 0	Robert Dougall, Boreland.
Naiad	5 Jan. 1859	29	Rate of 1 acre Sc.	16 hours	6 2 6	Walter Hallam, Dripmoss.
Shielhill	1 Mar. 1859	55	⅓ acre	3½ hours	7 5 0	John Marshall, jun., Templemill.
Tay Farm	24 Feb. 1859	36	¾ acre	6 hours	5 10 0	Thomas Keer, Cotley.
Upper Cairnies	12 Jan. 1859	37	2 roods 15 poles	5¾ hours	3 15 6	James Robertson, farm-servant, Williamston.
Whitteston	16 Feb. 1859	18	⅓ acre Scotch	4½ hours	3 0 0	James Eadie, Balhaldie.
RENFREWSHIRE—						
Barskiven	21 Jan. 1859	39	Rate of 1 acre Sc.	18 hours	6 17 6	James M'Killop, farm-servant, Fulwood.
Broadfoot	10 Feb. 1859	17	Rate of 1 acre	20 hours	5 5 6	John Morrison, jun., Corselees.
Flender	4 Feb. 1859	24	Rate of 1 acre	22 hours	4 1 6	Allan Clark, Flender.
Saterland	18 Jan. 1859	25	½ acre	9 hours	6 15 0	John Mercer, farm-servant, Priesthill.
ROSS-SHIRE—						
Brae	21 Jan. 1859	38	½ acre	5 hours	3 0 0	William Mackenzie, Tornich.
Goathill	10 Feb. 1859	19	¾ acre	7 hours	3 4 6	Alex. Tough, farm-servant, Stornoway Mains.
Skelbo	11 Feb. 1859	45	1 rood 26 poles	4 hours	4 18 0	Kenneth Mackenzie, Prony.
ROXBURGHSHIRE—						
Courthill	16 Feb. 1859	50	¾ acre	6 hours	17 18 0	William Hume, Wormerlaw.
Hassendean	3 Jan. 1859	46	½ acre	5 hours	10 0 0	Robert Scott, farm-servant, Trowmill.
SELKIRKSHIRE—						
Bridgelands	8 Dec. 1858	18	½ acre	5 hours	4 15 0	Andrew Moffat, farm-servant, Oakwood.
STIRLINGSHIRE—						
Pirnhall Farm	19 Jan. 1859	26	½ acre	5 hours	7 0 0	James Auld, Auchinbowie.
WIGTOWNSHIRE—						

THE MANURE OF OUR FARMS, CONSIDERED WITH ESPECIAL REFERENCE TO ITS COMPOSITION, INCREASE, MANAGEMENT, AND APPLICATION.

By HENRY TANNER, Professor of Agriculture, Queen's College, Birmingham.

[Premium—The Gold Medal.]

THE valuable fertilising matter we term farmyard manure, is a very variable and indefinite compound, generally composed of the straw which has been used as litter, intermixed with the excrements of live stock. Its quality takes a wide range according to the system adopted, and its quantity is equally regulated thereby; whilst its extreme value places it in a pre-eminent position as the most useful of all manures. In order that a clear opinion may be formed upon this subject, I purpose in the following Report to explain of what substances the manure of our farm consists—how it may be increased in quantity—it will then be desirable to trace the changes it undergoes by good and bad management—point out the channels by which loss is occasioned, or its fertilising powers increased—and then proceed to show how it may be most advantageously employed in promoting the fertility of the soil.

As farmyard manure is a mixture of several kinds of straw with the excrements of various animals, we might reasonably have anticipated a great variation in its character and composition. Knowing as we do the composition of different varieties of straw, we can with some degree of accuracy determine what materials the litter contributes to the manure, but it is very different with the food which is consumed by the stock; for although we may know the several ingredients which we offer to them as food, still, as animals, through different periods of life, and under changes of circumstances, make use of various portions of that food, sometimes in a greater, at other times in a less degree, it is manifest that the excrement, which is the residue, must be controlled by the demands of the system. For further illustration, let me refer to the *growing* animal which has to form its skeleton by accumulations from its food. Animals of this class, as well as those which are *breeding*, and have to form the skeleton of their young, these have to draw upon the food for the materials of which the bones are composed, to a greater extent than an adult animal which is not breeding. The food in such cases is almost entirely deprived of the carbonates, phosphates, and the alkalies as it passes through the system, and the excrements are proportionately impoverished. The same demand is made upon the

food of the *milking* animal; for milk—designed by nature to nourish the animal during its growth—contains a large supply of these salts. We are all familiar in practice with the comparative poorness of the manure from dairy or growing stock; and chemical examinations clearly prove that this inferiority of character may be traced to the deficiency of the phosphates and alkalies. On the other hand, when we are dealing with animals which are more fully matured, and are fattening them for the butcher, the oily portion of the food is that which is chiefly appropriated, whilst the residue or its substitute finds its way to the manure heap; and such manure is notoriously of very superior quality. It may, however, be said, that the cause of this difference must be traced to the richer food which is given to the latter class of animals. This is a valid objection so far as it goes; but *the same kind of food* given to a fattening animal, and also to a dairy cow, will give a manure totally different in fertilising powers. In the transference of vegetable and mineral matter into a form endowed with animal life, certain portions only are thus used, but the larger the proportion thus appropriated, the more profitable will be the use of the food, because it assumes a more valuable form. The reason for this deficiency being pointed out, is to show the reader in what respect his manure is impoverished, and not in any way to show that it is a sacrifice he should avoid. *Other* circumstances will decide whether he should use his land for rearing young stock, or as dairy land, or for fattening stock, or for a combination of the three; but he should know and remember the relative influence of his system upon the manure, and ultimately upon the fertility of the land.

For these reasons the composition of farmyard dung is very variable, and it is positively impossible to refer to any analysis as representing with certainty the composition of the manure of any farm; but we shall fall into error if we therefore undervalue the importance of chemical analysis, for whilst I state that no standard can be given of general application, I am also bound to say that we derive much information by chemical analysis as regards the most economical and judicious course of management by which to regulate its fermentation and decay.

I extract from an English agricultural journal* the following Table, showing the composition and value of two samples of good farmyard manure, containing a general admixture of the excrements from horses, cattle, and pigs, such as would be produced upon a well-managed farm carrying out a mixed system of husbandry, but in different conditions:—

* *Bath and West of England Agricultural Journal,* vol. v.

Composition and Value of Good Farmyard Manure.

	Fresh Manure. No. of lb. in each Ton.	Fresh Manure. Value. s. d.	Well Rotten. No. of lb. in each Ton.	Well Rotten. Value. s. d.	Price per lb.
Water,	1,482¼	...	1,689¼	...	...
Soluble organic matter,	55½	2 0	83	4 0	Ammonia, 6d.
Soluble inorganic matter,	...	...	...	...	...
Soluble silica,	5¼	...	5¾	...	...
Phosphate of lime,	6¾	0 5	8½	0 6½	¾
Lime,	1½	...	2½	...	...
Magnesia,	¼	...	1	...	...
Potash,	12¾	3 3¾	10	2 9	3 3/10
Soda,	1¼	...	½	...	...
Cloride of sodium,	¾	...	¾	...	
Sulphuric acid,	1¼	...	1¼	...	
Carbonic, and loss,	4¾	...	2¾	...	
Value of soluble matter,		5 8¾		7 3½	
		s. d.	lb.	s. d.	
Insoluble organic matter,	577	6 9	287¼	4 3	Ammonia, 6d.
Insoluble inorganic matter,	...	...	...	...	...
Soluble silica,	21¾	...	32	...	...
Insoluble silica,	12½	...	22½	...	...
Oxide of iron and phosphates,	13½	6½	21¼	8¾	Bone-earth at ¾
Lime,	25	...	37½	...	...
Magnesia,	3¼	...	2	...	...
Potash,	2¼	7½	1	3¼	3 3/10
Soda,	½	...	¾	...	...
Sulphuric acid,	1¼	...	1½	...	..
Carbonic acid, and loss,	10¾	...	29	...	...
	2240	7 11	2240	5 3	
		s. d.		s. d.	
Value of insoluble matter,	...	7 11	..	5 3	...
Value of soluble matter,	...	5 8¾	...	7 3½	...
Total value of a ton of manure,		13 7¾	...	12 6½	..

This shows a value considerably above our general ideas of such manure, although we only value the principal ingredients at their market value; but it must be remembered that this manure had been carefully preserved, and consequently was not injured by the loss of its soluble portions. It is worthy of notice in passing, how very small is the proportion of active fertilising matter even in *good* manure:—

	Fresh Manure. cwt.	qr.	lb.	Well Rotten. cwt	qr.	lb.
Active fertilising substances,	0	0	47¾	0	0	47¾
Other materials,	6	1	10	4	1	27
Water,	13	0	26¼	15	0	9¼
	20	0	0	20	0	0

If, then, the proportion of the most valuable ingredients is so small, does it not show how essentially necessary it is to preserve this portion of the manure from being lost? Whilst we retain the bulky portion, we must be cautious in retaining that which gives it vital energy.

Such being the composition of good farmyard manure in its two stages, viz.—when fresh and well rotten—we have now to consider the circumstances which regulate its quantity. These are the quantity of straw which the land produces for use as litter, and the amount of food consumed by the stock of the farm; consequently that course of management which favours these results will at the same time occasion an increased produce of manure. If you farm so as to produce an abundant supply of good manure, the future crops will prove highly remunerative. Guided by this principle, many of our best agriculturists have adopted the rule not to sell any farm produce except in its finished condition, as fat meat or corn, and only a moderate portion of the latter. The result has been an increased produce of most valuable manure, which has raised the quality of the land to a very high degree of excellence. There are many cases to which this rule is inapplicable, from local peculiarities of soil or climate; but every agriculturist may review such a system with advantage, and, in the general practice, adopt those modifications which are applicable to his own case.

All our farm produce may be divided into two classes—viz., corn crops and green crops; and practice has shown that a judicious rotation of these crops favours the productive powers of the land, and it is equally successful in increasing the quantity of our manure. The corn crops yield the bedding for stock, and the green crops their food: both are necessary, and their combined use is desirable. Presuming, as I shall do for the present, that the object is to produce a large quantity of manure, it is evident that this will be best done by the consumption of roots and hay at the homestead, and the liberal use of straw as litter. Not that as a rule you would alter the rotation, provided you have a fair and suitable intermixture of corn and green crops, but whilst the roots grown will to a great degree regulate the quantity of manure made during the *winter* months, by the introduction of such crops as vetches, rape, and clovers, for cutting as fodder for stock in summer, any surplus proportion of straw may be converted into manure. Under this system, well carried out, the farm increases in fertility, and thus from its own resources we have the means of improving the quality and general productiveness of the land. When the straw of a farm is abundant, it is often necessary to continue its conversion into manure beyond the period when the roots are consumed, and the use of fodder crops in such a case is very desirable. Should local circumstances render it undesirable to carry out this system, the use of linseed-cake, or some similar artificial food, with a smaller proportion of roots, will enable more stock to be wintered, thereby more straw made into manure, and its quality improved; whilst the additional expense for artificial food will be repaid by the stock, if used judiciously. This consideration of the production of

farmyard manure, the reader must remember, is totally distinct from an investigation of the question whether or not the roots should be drawn to the homestead or consumed upon the land. I have here simply to consider the best course of procedure when it is decided that manure shall be made at the homestead.

The reader is doubtless aware that, in the removal of our crops from the land, we take away certain materials which the plant has accumulated during its growth, and thereby we diminish its fertility. A part of the organic matter of the crop, and no doubt a large part, has been drawn from the air, whilst the residue of the organic matter, and the whole of the mineral matter, has been yielded by the soil. Under a judicious course of farming, the chief portion finds its way back again to the land, but under a bad system the return is not sufficient, and the soil deteriorates in quality. The sale of hay, straw, root-crops, &c., and the careless management of dung, are practices which have a tendency to injure the land. The former practices are seldom allowed unless compensated for by the purchase of manure; but the latter cause of loss is totally unsatisfactory, for, whilst it is a loss to the farm, there is no remuneration for it. If it is desired to raise the fertility of a farm, there is no system more generally calculated to accomplish this result than to establish a rule never to sell stock until fully fattened, nor any other produce except corn, and of this corn to reserve a portion for fattening the stock, or else to purchase food of equivalent value for this purpose. This system, combined with a suitable rotation of well-cultivated crops, and careful management of the manure made in the farm, cannot fail to be productive of a rapid increase in the fertility of the land. As I before said, local circumstances may prevent an entire adoption of this system, but all may derive advantage from it in a greater or less degree.

There are four distinct modes in which farmyard manure may be made—viz., in boxes or pits, in stalls, in hammels, and open straw-yards. Each of these plans has its advocates, and neither can claim the merit of being invariably the best. The *quality* of the dung produced would probably rank in the order in which they now stand—the box manure being the best, and the yard manure the worst. If a large *quantity* of straw has to be converted into good dung, the boxes would still be the best, and the stalls the worst. If, however, you consider the healthy growth of stock through the several periods of life, combined with the comfort of the cattle, then the hammel stands far superior to any other system for Scotland; for here exercise and shelter are combined, without the loss of comfort resulting from more powerful companions. And it is but right to add that, so far as the farm is concerned, the manure here made, is, under good management, nearly equal to box manure. The hammel, therefore, claims decided advantages in all cases except the final fattening for the butcher; and even

in this particular many also lay claim for its superiority over any other system. Whatever system is adopted, all loss by drainage must be jealously guarded against.

Farmyard manure is not only a very compound body, and composed of a great many ingredients, but these bodies have a great tendency to decompose, or, in other words, to change their physical and chemical condition. If you examine a piece of straw you will find that it will not dissolve in water; but before it can be useful by contributing to the support of a plant *it must become soluble in water*. If you burn a piece of straw, you disperse into the air much of its bulk, and a white powder remains which we call the ash. This is the mineral portion which was previously buried in the tissues of the plant, giving it firmness and rigidity through life. Now the decomposition of the straw produces a similar change, the chief difference being in the time, which is very much longer, when decay alone operates; but if the decay takes place under circumstances which secure the organic matter, the land becomes enriched by this portion not being lost. Besides the straw, we have in manure the excrements of various animals; these contain nitrogenised matter, which has a great tendency to decompose, and it also induces other bodies with which it may be in close proximity to commence a similar change. The result is, that when the excrements become intermixed with the straw a general decomposition is commenced, and it now becomes the duty of the farmer to regulate and control this chemical action so as to produce those new compounds which are most valuable as fertilisers of the soil.

In describing to the reader the changes which really take place in the chemical and physical modifications now to be considered, I feel that I shall best fulfil the requirements of this Report, by giving, in as condensed a form as possible, the material points which are most important for the agriculturist to know. The materials we have to deal with consist of two portions, which need separate notice —viz., the organic and the inorganic matter.

The *organic* matter is that portion which is dispersed into the air by combustion, and this change might also take place under decay. The component ingredients of this organic matter are four bodies, of which three are gaseous in their nature, and only one solid, and even this has a strong tendency to combine and become gaseous like the others; hence it need be no surprise that solid compounds, such as the various organic compounds of manure, should have this tendency to disperse themselves into the air. In practice we endeavour to avoid this dispersion into the atmosphere—our object is to secure them either in a solid or liquid form, in which state they are at our disposal—but once let them be scattered into the air, and your neighbour has an equal chance with yourself.

The fermentation of manure is quite under the control of the

operator, and the principles upon which it is based are very simple indeed. I have before said that decay is very similar in character to combustion, the chief difference being that the latter is a rapid process, whilst the former is slow. If you place a lighted taper in a bottle or other enclosed vessel, it burns for a short time, and then it gradually ceases; now this is because the air has been deprived of that matter which was capable of supporting combustion. In like manner, if you compress manure so as to exclude fresh supplies of air, that portion which is within the heap will soon be exhausted, and then fermentation will cease. On the other hand, if you throw the manure into a heap as lightly as possible, and give the air freedom of access, you enable it to obtain fresh supplies of air, and, consequently, fermentation goes on rapidly. Hence, in our ordinary practice, if manure is required to be preserved fresh and unfermented, we compress it as much as possible, whereas, if we want to render it rotten, the opposite course is adopted. Upon the same principle we are guided as regards turning our manure heaps; if dung is not sufficiently rotten, then it may be turned over so as to promote the fermentation; whereas, if it is sufficiently rotten, such a course is undesirable. Thus we can hold the fermentation of dung entirely under control. To promote the fermentation, the admission of air is the source of power; but the reader must be informed, that whilst fermentation and decay are, like fire, valuable as servants, yet they are most destructive when beyond our control, as I shall now proceed to show you more fully.

To promote the formation of those bodies which are most desirable for the quality of manure, a sufficient supply of air and water is necessary; neither alone will be sufficient, for it is by their *combined* action that the best results are obtained In this manner the carbonaceous matter present becomes formed into organic acids, which form new compounds in the manure instead of being changed into carbonic acid gas, which would be dispersed into the atmosphere. At the same time, these circumstances—the presence of air and moisture—also act favourably upon the nitrogenised matter, which becomes transformed by the decay into ammonia; and if the organic acids are present, we have a combination by which humate of ammonia, or some similar salt, is formed. If, however, *from a deficiency of moisture*, carbonic acid has been formed, then we have a carbonate of ammonia formed, which is volatile, and *readily passes into the atmosphere;* when the humate of ammonia is formed, this is not volatile, but *remains in the heap* It readily dissolves in water, and therefore may be washed out of the heap; but, under proper management, this does not arise. When you remember the great value of ammonia as a manure, and observe that whilst under one system you may to a large exent disperse it into the air instead of retaining it in the manure-heap, it cannot fail to impress us with the

importance of understanding how you should regulate the decomposition of our manure-heaps so as to retain these valuable elements, instead of dispersing them into the atmosphere for the general good. Dr Voelcker, whose chemical investigations upon this subject are most important, has shown that, in the centre of dung-heaps which are allowed to become very hot, the ammonia is almost entirely formed into a carbonate; but where the supply of moisture has been sufficient, then it is produced as the humate of ammonia, or some similar salt. It does, therefore, appear to me that, knowing the cause, the remedy will immediately suggest itself—viz., that when the fermentation of a manure-heap is proceeding rapidly, an occasional supply of water, or, what will be still better, liquid manure, should be pumped or thrown upon the heap—not enough to cause a drainage, but still sufficient to soak into the centre of the heap. In this it may be aided when necessary by sinking an iron bar, and thereby making a passage into the centre In fact, this may be adopted as a test for the heap. If, on piercing it with an iron bar, the centre proves to be hot, then you have a proof that moisture is necessary , if, on the other hand, there is no heat, then you may be equally confident that moisture is not required—still, a moderate supply will be far from prejudicial. If it is necessary for the more complete decomposition of the dung to turn it so as to admit air, then be especially guarded, and take care that sufficient moisture is also added at such intervals as may be necessary. Remember, that by the admission of air you are stimulating a slow fire, which, if allowed to proceed unchecked by the presence of moisture, will dissipate into the air much valuable fertilising matter; but, if judiciously controlled, you will be able to change the condition of your manure, whilst at the same time you will secure all its fertilising matters.

The process of fermentation is of considerable practical value, because we thereby change *the condition and composition* of the manure. We have to deal with materials *which have been employed* for the discharge of certain functions and duties, and consequently, in their present condition, are no longer available for performing over again the same duties But Nature has, with economic wisdom, arranged for the repeated use of the same materials for the discharge of similar duties; thus she has stamped upon them laws of change, and thereby these materials are again prepared to perform anew the same circle. Thus, from matter which has discharged its functions, we have the elements set free which will support the functions of life and minister to the development of vegetable and animal life. The process of fermentation is therefore necessary to resolve the various organic matters of fresh manure into new compounds suited for vegetable nutrition; and by its judicious regulation we have the opportunity of preserving these elements in a valuable form, whilst by careless

management we incur a serious loss in effecting the transformation.

The influence of fermentation is not confined to the organic matter, for it has a powerful influence upon *the inorganic or mineral matter of manure.* I have before stated that during the plant's growth this mineral matter has given strength and firmness to the various parts of the growing plant, and acted like a skeleton in enabling the soft tissues to maintain their proper form. Now, however, we want this mineral matter to be set free for use again, and hence it becomes necessary to break up by decay the organism of the plant, so as to present these materials for solution in water, and thereby ready for passing into vegetation. The chemical changes are confined chiefly to the organic matter of the manure, which we thereby endeavour to render soluble for the double purpose of contributing to the nourishment of vegetation, as well as setting the mineral matter free for a similar purpose. Whilst, therefore, the elements of the organic matter perform some very interesting but somewhat complicated chemical changes, the inorganic elements participate therein only to a small extent. The chief influence upon the mineral matter appears to be to set it free from the vegetable tissues in which it has been secreted, thereby to render it available for again contributing to the support of vegetable life. These are the principles upon which the management of dung is based, and now I shall proceed to show their practical application.

In order that we may trace the progress of manure through its several stages, we must at first notice it *during its accumulation.* In this stage it receives very different modes of management; some persons allowing it to be thrown into a straw-yard, where young stock are ranging, treading down as much straw as possible; and from such yards we often see a considerable drainage of liquid manure which is generally lost; on other farms it is preserved with such scrupulous care that it is protected from rain and sun by a roof, whilst drainage is prevented by a pit having an impervious bottom and sides, and in these manure-sheds it is often kept entirely free from stock. In other cases a medium course is adopted, drainage is prevented, and the manure is well trodden by stock, whilst it gets moisture from rain. Let us examine into the relative merits of these plans. It is needless to attempt any proof of the fact that the first plan is far from being desirable, for the drainage from the yards being in a great measure lost, deprives the manure of its powers of vitality; and well has such washed manure been spoken of by the well-known author of *Chronicles of a Clay Farm*, when he describes the dung-cart as "the creaking hearse that is carrying to the field the dead body whose spirit has departed." We have already seen that, as the fermentation proceeds, so the dung becomes more and more readily dissolved by water; and hence, when thus unprotected, we allow it to be carried off just when it is prepared

to be most useful. -Such loss is manifestly injudicious, and should certainly be avoided. The treading of stock is calculated to assist in breaking up the vegetable tissues as the rotting proceeds, whilst it does not in any way injure the manure; but, as we shall shortly see, it has a favourable tendency. The second plan—viz., that of preserving the manure in sheds—has much to commend it to our notice. Waste, by the washing of rain and drainage, is here quite prevented; but is there no other mode of waste which is too often taking place? My own impression is, that such is the case far more frequently than we imagine. I have before compared the process of decay to the action of a slow fire, and I have shown that when the fermentation of dung takes place *without moisture being present*, that we get *volatile* products instead of only *soluble* matter. This action takes place in the majority of covered dung-pits. It is true we shield it from rain, but we too often overlook the necessity there is for water in the economic fermentation of dung. Thus, whilst we avoid one error we fall into the opposite. This evil is increased by stock not being allowed into the shed to tread it down, and consequently the manure, as the accumulations are added, becomes thrown together lightly; we thereby encourage fermentation by the access of air, whilst by keeping away the water we allow the process of decay to dissipate into the air much valuable fertilising matter. The third system avoids the loss by drainage, and has the recommendation of the manure being kept moist as well as compressed by stock. It cannot be denied that these are desirable points, and should be valued accordingly; but even here the same rule is not of general application, for it must be regulated in some degree by the fall of rain. If it be a correct practice when the fall of rain is small, it cannot be so when the fall is three times as much; consequently, it is generally desirable, when the fall is excessive, that we should take precautionary measures to protect the manure. The fall of rain exerts an influence upon the relative value of hammels and larger straw-yards; for where the latter are preferred, there you find the climate to be dry, while the districts adopting the hammels have generally a wetter climate. As the rain increases, so it becomes more desirable to decrease the quantity of yard room and increase the proportion of shedding, and this is just what the hammel system does. The necessity for the protection of manure from rain is readily determined by any observant farmer. If he has secured the yard from the escape of liquid, and also taken off his roof-water by proper spouting, and he then finds his dung becomes too moist, he has the option of using more straw, or of concentrating his stock into smaller spaces—thereby he virtually decreases his fall of rain—for if you concentrate the manure over one-half the area, then you can only receive one-half of the quantity of rain upon the same bulk of manure; and if

you notice the farmyards of different districts, you will observe all the gradations between the very large straw-yards of some of the eastern counties of England, and the smaller hammel and shed so general in Scotland. I may be expected, however, to give a definite reply to the inquiry, whether or not manure-pits should be roofed over? I reply, that observation can alone decide. I can with confidence say, that you should keep your manure moderately moist, but it is for you to decide how this can best be done under the peculiar circumstances of each farm; for the fall of rain, the proportion of straw used, the number of stock kept, and the character of food, &c., &c., these all modify the result, and prevent any positive rule being laid down. I have before explained that, besides keeping the manure moist, it should be kept moderately compressed, loss by drainage avoided, and these are the three principal conditions to be observed in keeping the manure during the period of accumulation.

The greater portion of the dung is made at the homestead during the winter and spring months. If, however, the summer feeding of cattle in the buildings is carried out, this is an exceptional case, and generally renders a covered manure-pit or shed desirable, and I may even say, almost essential, for we have now another influence to contend against, viz.,—solar heat. In the colder months of the year you do not consider its influence, because it acts with so little energy, but it is totally different in the summer months; and as this injurious action is most powerful during the period of accumulation, it is the more necessary to be upon the guard. You will shortly see that when the process of fermentation has been completed, then the action of the sun upon the ammoniacal ingredients is very slight; but in the early stages it renders much of the ammonia *volatile*, and thereby it is dissipated into the air.

We may now proceed to consider its management in the second stage, or when it is *in the heap*. Here we shall find an application of the same principles as I have already named to be of essential importance. The foundation of the manure should be as impervious as possible, and, upon large sandy farms, it pays very well to have bottoms properly puddled with clay, and used as the regular situations for dung-heaps. These are, of course, selected in positions convenient for two or more fields. Having chosen the spot for the heap, the next point to be considered is, whether the dung should be encouraged in its fermentation, and thereby rendered more rotten, or its decay checked and its freshness preserved. If the former case, then the dung should be thrown down, and the heap regularly built by the dung being thrown on it by hand labour. If, on the other hand, fermentation is to be checked, then the bottom of the heap should be prolonged at each end, the carts driven upon the heap and there unloaded. Thus the heap will become thoroughly compressed, and it should subsequently have the

ends cut back, so as to bring it into form, and soil banked against the sides for twelve or eighteen inches high, and a coating of soil thrown upon the top. A heap of the latter description needs but little attention after it is made, but the former it will be necessary to watch with care; for the reader will remember that, as we have put it in a condition so as to promote a rapid fermentation, so we must from time to time add to it those supplies of moisture which will regulate the fermentation and promote the formation of ammonia in combination with the organic acids, rather than produce it in a volatile form, when it is so apt to be lost. The only other point connected with the management whilst on the heap is the condition of the dung when it is going to be applied to the land. If, as the time approaches for the dung being used, it does not appear to be sufficiently rotten, then it must be turned and well shaken into a new heap, and thereby we stimulate the chemical changes of the dung, and quickly reduce it into a sufficiently rotten condition; always bearing in mind that, if you admit air for rendering the fermentation rapid, you must be especially cautious to supply a proportionate quantity of moisture to regulate the character of the product.

We may now proceed to notice *the use* of farmyard manure, and the manner in which we should modify the time and mode of application, according to the varying character of the land. The manure acts upon the land in a two-fold character, for it exerts a *physical* action upon the soil as well as a chemical agency. Under the former agency we find it giving stability to light sandy soils, and making them more absorbent of moisure—rendering tenacious clay-soils more open and friable in their nature, and thereby admitting the freer passage of the rain and atmospheric air, as well as promoting the decomposition of these soils, and thereby rendering them more fertile. Thus we find farmyard dung performing functions totally different in their character, according to varying circumstances. The judgment of the farmer regulates this modification, for experience has taught him that if he wants to overcome the adhesive character of a soil by the use of farm-yard dung, he must apply it in a different condition to what he would if he wanted to give firmness and stability to a soil. He has arrived at the conclusion that for dung to act mechanically in rendering a soil more open and to overcome its tenacious character, he must let the manure retain much of the rigidity of the straw, or, in other words, it must not be much rotten. Experience has also proved to him that, in using it for very porous soils, which need to be compressed rather than rendered open, then the natural toughness of the straw should be entirely overcome, and the dung used in a rotten state. In whatever state, then, it may appear desirable to apply the manure, you can by fermentation reduce it to it, even if you need it so completely decomposed that it assumes a soapy condition. Judgment must be shown in the use

of the agency I have already described, and by these means you are certain of attaining the required result. You must, however, bear in mind the great need there is for caution, so as to regulate properly the important chemical changes you have completely under your control. With discretion and care, the mechanical action of dung is thus held at your command.

There are other duties discharged by dung which may be grouped together under the term of chemical action. Here we have powers totally distinct from the former; for, whilst it devolves upon the former agency (the mechanical) to render the soil adapted for being traversed by the roots of the growing crop, the chemical powers supply that nourishment which is needed for the development of the crop. It is, therefore, in their combined action that the most desirable results become manifest. It is, however, worthy of inquiry, whether or not the use of fresh dung for stiff land, and rotten dung for porous land, is supported and confirmed by the chemical character of dung? When fresh dung is used upon stiff land, we find that the decay which then takes place acts upon the land, and renders the dormant ingredients of the soil active, and thereby converts matter which could not nourish a plant into valuable food for vegetation. It also imparts to the soil a beneficial warmth which is favourable to germination and vegetable growth. In addition to this, the absorbent powers of the soil seize and retain the products of this fermentation of the dung, and secure them until required by the growing plant. In the case of a sandy soil, the circumstances, as well as the powers of the soil, are totally different. The porous character of the soil is decidedly unfavourable to its powers of retaining manure; and consequently we cannot look upon such soils as safe guardians of manure, and for this reason the manure should be added so as to be immediately available for the crop. The manure, consequently, is more suitable when well rotten, upon chemical grounds, as well as upon a consideration of its mechanical character. The same principle is applicable to all the intermediate descriptions of soil, modified by the same rule.

The time of application is a most important consideration, and well worthy of a careful inquiry. I have already made a casual reference to the absorbent powers of the soil, and it now remains for me to state that the researches of Professor Way have thrown much light upon this subject; and we are thereby led to the conclusion that this influence is most powerful in soils containing an abundance of clay, whilst soils deficient in clay possess this power to a small degree only. It has also been shown that the use of lime as a manure increases this absorbent power very materially. This variation of character consequently guides us very materially in the time of applying our dung. If a soil is almost destitute of this retentive power, it is manifestly impolitic to bury manure long before it is needed, because, although we might protect it from waste when

in the heap, still, after it has been applied to the soil, it is clearly out of our control. The case is very different upon stronger land; for as we can with safety and confidence intrust manure to its custody, it is clear that if *other* circumstances render it desirable to apply this manure early, then we need not entertain any fear that its fertilising powers will be wasted. We can, in the case of clays, loams, and marls, apply the dung as may be otherwise desirable; whilst in the case of sandy soils we are compelled to use it as short a time as possible before the sowing of the seed.

In noticing somewhat more fully the time to apply dung upon our clays, loams, and marls, there are two or three points which are especially worthy of consideration. An economy of horse-labour may induce a person to apply his manure in the autumn and early winter, as this is a leisure time, whereas the months of April and May are generally a period when work presses heavily. If, therefore, we can, *with equal advantage,* use our farmyard manure thus early in the season, it is clearly advisable to do so; and as the horse-labour incidentally connected with it is very considerable, it becomes highly important to get this labour done during a leisure time, rather than postpone it until the season when the horse-labour is more in request than at any other part of the year. A second inducement which may be named is connected with the manual labour; for if we can, in like manner, have this work done when our labourers are not pressed with work, it will leave them free for other necessary duties of the spring. Besides this, we must not lose sight of the fact that, so long as the dung is out of the land, expenses will be continually incurred for making and turning dung-heaps, loading and unloading, &c. Now, it is clear that, if we can use our own farmyard manure, *with equal advantage* to the land, early in the winter, and in a fresh and unfermented condition, it is very desirable that we should do so. The question, therefore, resolves itself into a new form, viz.—the advantage we gain by carrying out the fermentation of farmyard manure above the soil, and in reserving it for use in spring. Taking practice as my guide, I find but one opinion expressed by those farmers who have tried the relative advantages of ploughing in dung in a slightly fermented condition in the autumn or early winter, and in the spring months, *upon either clays, loams, or marls.* The invariable testimony is in favour of the early use of the manure. If it needs further confirmation, it receives it in the fact of its rapid extension. I consider, therefore, that the evidence of practice is a powerful argument in favour of the system; still it may be desirable for me to offer some explanation of this fact.

It would be out of place for me to go into that deeply interesting subject—the absorptive powers of our soils; but I may say that it is established by numerous investigations, and therefore with the fact alone I have now to deal. This power consists in separating fertilising matters from solution, and retaining them

until wanted by the crop; consequently, when manure is buried in the soil, as it decays it is dissolved by the rain passing through the soil, but it is immediately seized by the absorbent powers of the soil, and taken care of. In sandy soils, as the manure rots and dissolves in the rain, so it passes down below the soil, and hence these soils are called "hungry soils," whilst clayey soils are distinguished as "holding land." This power of the soil preserves all that we intrust to it; and therefore when you have buried the dung in such soils—viz., clays, loams, and marls—you may consider it safe. But how is it with that which we retain in our sheds and heaps? With *care* we can control many channels by which great losses are often made, and to a certain extent prevent them; but we know full well that, with all the frailty of human nature we have to contend with in our labourers, and too often in ourselves also, work is not always done as it might be, and losses do arise. If you refer to the analyses already given (pp. 82-83) of fresh and well-rotten dung, you will see that, *even when care has been taken* with the fermentation of dung, and labour expended upon it, that it is actually of less pecuniary value in the latter stage than in the former. How much greater will the difference be when the fermentation is neglected and uncared for! If, therefore, we add to the inducements already named for applying dung to clays, loams, and marls, as early as it can be done conveniently—viz., the economy of manual and horse labour—the additional claim of *an economy of fertilising matter*, we need not be surprised that this practice is found to succeed so well, and to rise so high in general favour.

There will, under any system, be manure left for use in the spring, and many will doubtless be desirous of using it rather than keep it until the following autumn. I do not know that its use needs any special notice from me, but I may suggest the propriety of not exposing the dung long under the action of the sun; for, in the imperfectly rotten condition in which such dung would be used, this could only injure it, and retard its subsequent decay in the soil. It would injure it, because, as the reader knows, *in this condition* the sun draws off some of the ammoniacal compounds, and it delays the fermentation, because, if buried *dry*, and this is followed by dry weather, it does not ferment as well as if ploughed in fresh and moist. The work should therefore be so arranged as to avoid any unnecessary exposure.

These remarks apply to the use of manure when it has to be ploughed beneath the soil, but farmyard manure is often used as a top-dressing for young clovers, and also for pasture-land. It is a practice which has long been adopted throughout the kingdom; it has stood high in favour amongst practical men, who found it a successful practice, but it has been loudly condemned by others as an extravagant and wasteful mode of using it. In an able investigation which has been carried out by Dr Voelcker, he points out the key which unlocks the secret of the practice. He there shows that, in

well-fermented dung, the ammonia exists in combination with the organic acids, forming compounds which are not volatile. The original ground upon which it was condemned was, that in consequence of the *volatile* character of ammonia, we lost considerably by the practice. A more complete knowledge of the character and composition of dung thus confirms the experience of the past, and points to the *well-rotten* manure being of considerable value as a top-dressing for the land.

I have thus brought under consideration the principal circumstances, conditions, and influences which affect the value of farm-yard manure. It is a subject which most highly merits our care and preservation, and it will well repay for an economical increase in its quantity, as well as for its judicious management and use.

BYE-LAWS REFERABLE TO THE PROVISIONS OF THE CHARTER.

The following Bye-laws, having received the *interim* approval of the last General Meeting, will be submitted, in terms of the Charter, for the sanction of the General Meeting in January.

1. *Annual Subscription of* £1, 3*s*. 6*d*., *and Life Composition.*—That the Ordinary Members of the Society shall pay at admission, and afterwards annually, in advance, the sum of £1, 3s. 6d., with the option and power of redeeming the same by payment of Twelve Guineas, as the purchase of a Life Subscription; and which Life Subscription may be so purchased under deduction of any annual payments that the Member may have previously made, with this limitation, that at no time shall a Member have the power of redeeming the annual payments for a less sum that £7, 1s., or six years' annual contributions.

2. *Annual Subscription of* 10*s*., *and Life Composition.*—That Tenant-Farmers, Secretaries and Treasurers of Local Agricultural Associations, Factors, and Proprietors farming the whole of their own lands, whose assessment in the Valuation Roll does not exceed £500, shall pay at admission, and afterwards annually, in advance, the sum of Ten Shillings, with the option and power of redeeming the same by payment of Five Guineas as the purchase of a Life Subscription.

3. *Election of Members.*—The mode of Election of Members of the Society shall be by ballot, at either of the stated General Meetings,—at which at least twenty Members must be present. The names of all Candidates for admission as Members shall be lodged with the Secretary, and laid before the Directors, previous to the General Meeting at which they are to be proposed; and such persons, whose names shall have been so lodged, as shall be approved of by four parts in five of the Members balloting, shall

be declared to be duly elected. Honorary or Corresponding Members or Associates shall not be declared duly elected, unless three-fourths of the Members present at the General Meeting at which they are proposed shall have voted for them.

4. *General Ballot.*—The Society, when a ballot for Ordinary Members is to commence, and after the names and designations of the Candidates have been read over, shall have the power, by the unanimous consent of the Members present, to dispense with the form of individual ballot, provided it shall appear to the satisfaction of the Meeting that the names of the whole Candidates on the list have been read and approved of in and by the meeting of the Directors immediately preceding such General Meeting; and, in this case, the election shall be deemed and held to have been made by ballot, according to the intent and meaning of the Charter.

5. *Election of Office-Bearers.*—The President shall not continue in office for more than four consecutive years. The two Senior Vice-Presidents, and the seven senior Ordinary Directors, and such number of the Extraordinary Directors, not being fewer than Two nor more than Five, as the Society may determine, shall retire annually; and the President, Vice-Presidents, and Directors, Ordinary and Extraordinary, who so vacate office, shall not be eligible to be re-elected in the same capacity for at least one year. Any Ordinary Director who shall not have attended a meeting of the Board of Directors for one year, unless prevented by bad health, shall be held to have vacated his seat in the Direction. The list of Office-Bearers to be proposed by the Directors for election at the General Meeting shall be published in any two or more of the Edinburgh newspapers, fourteen days preceding.

6. *Meetings of Directors.*—The Board of Directors shall meet on the first Wednesday of each month during the sittings of the Court of Session, and occasionally, as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Committees shall be appointed by the Directors, and shall in all cases report procedure to them for their consideration and approval. The Directors shall keep a record of their proceedings, to be laid before the General Meetings for their consideration and direction. All Members of the Society, though not in the Direction, may attend the meetings of the Directors and deliver their opinion, but they shall have no vote. The President, Vice-Presidents, Directors, Ordinary and Extraordinary, Treasurer and Honorary Secretary, shall be entitled to vote at meetings of the Board.

7. *Motions at General Meetings.*—That at General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision, unless notice thereof has been given a week previously to the Board of Directors, without prejudice, however, to the competency of making such motion or proposal to the effect of its being remitted

to the Directors for consideration, and thereafter being disposed of at a future General Meeting.

8. *Duties of Secretary.*—The Secretary shall write the minutes and proceedings, carry on the ordinary correspondence of the Society, and superintend the keeping of the records, papers, and correspondence. All records, papers, correspondence, and accounts shall be subject to the inspection of the Board of Directors, or any Member thereof.

9. *Secretary to act as Collector.*—The Treasurer, if he does not collect himself, shall nominate the Secretary as Collector, and the Annual Subscriptions and Life Compositions of Members shall be paid to him in that capacity.

10. *Warrants for Money.*—Orders or Warrants for the application of money shall be attested by the signature of the Secretary, previously to being signed by the Preses of the General Meeting, or of the Meeting of Directors at which they may be authorised.

11. *Auditor of Accounts.*—The Society shall, at the General Meeting in January, elect a professional Accountant, as Auditor of the Society's Accounts, who shall accordingly audit the Treasurer and Collector's Accounts annually, and for that purpose all necessary data shall be furnished to him by the Secretary not later than 30th November.

12. *Annual Accounts.*—The financial year shall be reckoned from the first lawful day of December to the last lawful day of November. A detailed annual Account of the Income and Expenditure of the Society, and of the State of the Society's Funds for that period, shall be submitted to the Directors in December, and the Abstract thereof required by the Charter shall be published in the Society's Transactions on the 1st of January following; the detailed Accounts and State of Funds shall be laid by the Treasurer before the General Meeting in January, such Accounts and Abstract being under the signature of the Auditor, and of two Members of the Committee of Finance.

13. *Auditor's Duties.*—In the examination of the Accounts of the Secretary and Collector, which shall be kept in a form to be approved by the Directors, and shall exhibit the whole of the monetary intromissions of the Society, it shall be the duty of the Auditor to direct his attention to all points essential to a *bonâ fide* audit, including the ascertainment of the following particulars:—

1st, The due realisation and bringing to Account of the various items of which the Society's Income is composed.

2d, The accuracy of the Entries and Summations of the details of Charge and Discharge.

3d, The correspondence of the details of Discharge with the Vouchers for substantiating them.

4th, The sufficiency of the authority for Disbursements, both in reference to the Warrants of the Directors, or of General Meetings.

5th, That the requirements of the Charter, with respect to Capital, have been observed.

ACCOUNT OF THE EDINBURGH SHOW.

By PETER M'LAGAN, Jun., Esq., of Pumpherston.

It was not without hesitation that I acceeded to the request of the Committee of Supervision of the Edinburgh Show, to draw up a report of the Show. Considering the extent of the Show, the variety of the stock and articles exhibited, the limited time allowed for that minute examination and accurate observation so necessary for the writing of a report, I felt that the duties required of me were more than one individual should undertake, even though he were more accustomed to, and more competent for such work than myself. But being led to understand that every assistance would be afforded me by the Judges and others immediately connected with the Show, I consented to use every effort to forward the object the Committee had in view—viz. that of presenting to the members a report of the Show. It must be mentioned that neither the Directors of the Society, nor the Committee of Supervision, are responsible for any thing advanced in this report. And I have endeavoured in my remarks to avoid anticipating the opinions of members by expressing any decided views of my own on the numerous changes which were introduced this year in the whole proceedings, which must be held in a great measure as experimental, and on which it may legitimately be supposed there may be some discussion at future meetings of the Society.

While I accord to the Judges, generally, my thanks for the courtesy uniformly shown me by them during the Show, my special acknowledgments are due to the Secretary and his assistants, for the facilities they afforded me for obtaining the requisite materials for this report; to Messrs James Melvin, Bonnington; George Bertram, Sciennes Street, Edinburgh; J. Stirling, C.E., Edinburgh; J. Lennie, Lauder Barns; R. Russell, late of Kilwhiss; J. Gibson, Woolmet; J. Douglas, Athelstaneford; David M'Culloch, Auchness; J. Waugh, St John's Kirk; J. M'Laren, Monzie; W. M'Combie, Tillyfour; J. Penny, Bartlehill; J. Wilkin, Tinwald Downs; W. Forrest, of Treesbank; T. Cartwright, Well Vale, Alford; J. C. Langlands, of Old Bewick; John Robson, Byrness; R. S. Skirving, Camptoun; H. Watson, Keillor; and Anthony Cruickshank, Aberdeen. I have also to acknowledge having been greatly assisted by Stephens' *Book of Farm Implements and Machines*, the accurate, full, and detailed descriptions and engravings in which, of most of the implements and machines exhibited, aided me materially in my descriptions when I had neither models nor other engravings before me.

The Directors were very fortunate in the choice of a site for the Show-yard. About 18 acres of the north-west portion of Sir John

Warrender's ground, called Bruntsfield Park, were inclosed for the purpose—the park wall being the north and east boundary of the Show-yard, and a high close erection of planks fenced it off on the other sides. The firm old turf resting on a porous subsoil, offered a suitable surface for the different requirements of the Show, being in hot weather agreeable to the visitors, elastic and sound to the tread of the animals, with no noise or dust, and causing not the slightest injury to the implements and machines resting on it, or moved over it; while the dry nature of the soil and subsoil, and the toughness of the sod, prevented the discomforts of muddy walks after the heavy showers which now and then fell on some days of the Show. The natural slope of the field was also most favourable for the exhibition, and was fully taken advantage of in the arrangements. There was a gentle slope from the north wall to the middle of the yard, in which the machinery and implements were placed, occupying 7 acres of land. Beyond this, to the southern wooden fence, there was a level plain, on which were erected commodious and comfortable wooden sheds, in parallel rows from east to west, for the live stock and other purposes. The horses occupied the southernmost row; the second row was devoted to the polled and Ayrshire cattle, on the east; the short-horns on the west, and to the ladies' refreshment room; the committee-room and the butter in the centre. The third row was occupied by the Highland cattle, crosses, southdowns, and blackfaced sheep, on the east end, and by Leicesters and cheviots, on the west. Other three short sheds formed the fourth row, which were occupied by the long-woolled sheep, swine, and poultry; while at the west end of the yard, facing the ends of the sheds, was placed the large refreshment-room, with the yard for provender for the stock behind it. The sheds were all double, a close partition running their whole length, dividing them into two. Wide avenues separated the rows, along one of which were erected, by Messrs G. Smith and Co., Glasgow, fountains, from the main one of which, placed before the committee-room, the water played in one unceasing stream; while the others were used as drinking fountains by the spectators, or for obtaining water for the stock.* In every respect the arrangements were admirable, and reflected the greatest credit on the Secretary, who had the planning and superintendence of them—on Mr Slight, to whom was intrusted the arrangement of the implements—and on Messrs Watherston, the contractors for the yard.

But while we thus describe the advantages of the Show-yard for the practical purposes of the exhibition, we ought not to forget to notice the beauty and picturesqueness of its situation, which was a constant subject of remark by the spectators, notwithstanding the distracting excitement and bustle which prevailed in the yard. Nor ought beauty of situation to be overlooked in the choice of a show-

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* These fountains were specially commended by the Judges.

yard; for while it is true that practice utilises beauty, it is as true that beauty refines practice. Situated on a gentle eminence, and surrounded by fine old trees, the Show-yard possessed all the retirement of a rural retreat, while it commanded views of that scenery for which the neighbourhood of Edinburgh is celebrated. To the east we were confronted by the bold precipitous face of Salisbury Crags, and the imposing form of Arthur's Seat, which, *lion-couchant*-like, watched as guard over the treasures of industry spread out at its feet; to the north, the roofs of the houses peering over the trees; the beetling rocks of the Castle Hill; the commanding battlements of the Castle frowning down upon us; and the spires and monuments glimpsing through the foliage, reminded us that we were in the neighbourhood of a city teeming with population, famous in history, and renowned in literature, science, and art.

Friday and Saturday, the 29th and 30th of July, were devoted to the receiving and placing of implements and machines.

On Monday the 1st August, the judging of them was proceeded with; and the thrashing-machines entered for competition were tried at the farm-steading of Myreside, none being admitted but the Judges, and those immediately connected with the trial.

On Tuesday forenoon the judging of implements was continued, and such as the Judges selected for trial were despatched to the trial field at Myreside. The trial of the thrashing-machines was also continued, to which the public were now admitted. In the afternoon the trial of the implements took place in the presence of a large concourse of spectators, who took the liveliest interest in the proceedings. The mowing-machines were first tried on some second crop of clover, which, from its thinness, was not the most favourable for the working of these machines. Notwithstanding, Burgess and Key's mower performed its work to the entire satisfaction of the Judges and the spectators. It took in a breadth of 4 feet 8 inches, and was calculated to cut 1 imperial acre in the hour. It is only adapted for cutting grass, which it does perfectly, the knife-edged cutter being used, while in their reaping-machine the serrated cutter is applied. We may mention that it was at the request of different parties these mowers were tried, there being no premiums offered for them. The other machines tried were Gardner and Lindsay's, and Wood's. There was one fact appeared to be established by this trial, and that is, that the same machine cannot be adapted both to mow and reap effectually: the "mower cuts too close to the ground for reaping, and the reaper has a tendency to press down the grass, and thus, in much of the operation, passes over the grass without cutting." Messrs Burgess and Key have, therefore, wisely exercised their faculties in producing two perfect machines, rather than a combined one, which professes to perform both operations, but fails to do either properly. The horse-rakes were afterwards tried on the grass that had been cut, which was ill-adapted for such a trial; and the Judges wisely

resolved to postpone their decision on them till they had an opportunity of trying them on some cut grain. The harrows, rollers, Norwegian harrows, clod-crushers, grubbers, and ploughs, were then severally tried, the latter on the land where the clover had been cut, the former on a part of the same field that had been previously ploughed up. The soil was gravelly; and from the long tract of dry weather which prevailed previous to the trial, was rather hard for ploughing, which was upon the whole unsatisfactory, the circumstances being more favourable for the wheel ploughs than for the swing ones. Nor could such implements as the Norwegian harrows and clod-crushers be sufficiently tested on land of that description, or their excellences be fully brought out, as they are more adapted for the reducing of clay land, where only they can be seen to work to perfection. The grass which had been ploughed down was of great use in testing the grubbers, as it discovered those which were most liable to choke in dirty land.

The live stock began to arrive as early as Monday, 1st August, though the time advertised for receiving them was not till Tuesday afternoon. Fortunately everything was ready for them; and the owners had the satisfaction of knowing that their animals were comfortably housed in quarters quite free from anything like infection. The stock generally, however, was not brought forward till Tuesday afternoon and Wednesday morning, the time advertised for receiving and placing it. Shortly after 7 o'clock on Wednesday morning, the Judges of the live stock commenced their arduous duties, which were concluded, generally, long before the time allowed for the admission of the public at 2 o'clock. By that time a large crowd had collected at the doors, so that when they were opened there was a rush into the yard, and for some time a continuous stream of spectators poured in. The price of admission this afternoon was 2s. 6d.; and all members having tickets were admitted free on this and the other days of the Show. We may mention that tickets of admission were sent round to all members residing in the district of the Show, without application; and all other members who applied for them before and during the Show, at seasonable times, received them. There was collected at the doors this afternoon a sum of £473, 3s. 2d.

The public were again admitted on Thursday morning at seven o'clock, at 1s., and those who were really desirous of seeing the exhibition availed themselves of this privilege by being present at this early hour, from which time, till far on in the day, there was not the slightest interruption to the flow of human beings at all the doors into the showyard. At some times more than others, shortly after the arrival of any of the large cheap trains, the pressure was greater at the doors; but, owing to the capital arrangements, little inconvenience was felt. The crowd was much increased on Thursday by the greater part of farm-labourers' tickets being made use of on

that day. There was about £1362 collected at the doors. It is difficult to say, definitely, how many entered the Show-yard on Thursday, or were present at one time in it; but it is generally supposed that not fewer than 35,000 passed through the gates, and that at least 25,000 were present at one period of the day, though, owing to the extent of the ground, it was difficult to realise the presence of such a concourse of individuals. At this time the yard presented a most animated appearance—the thousands moved on intent on observing and expressing their admiration at the different things which met their views—the animals were not always the mute subjects of their observation, as the spectators clustered round to examine some of the prize ones most admired; the steam-engines hissed and whistled, and the discordant sounds of thrashing-machines, winnowing-machines, straw-cutters, turnip-pulpers, &c., mingled with the complaining grunts and screams of the swine when some individual of more than ordinary curiosity poked them up from their slumbers, were a clear indication of the manner in which not a few of the visitors were occupying their time. Notwithstanding the great crowd, there was no disagreeable jostling or crushing at any part of the yard; a circumstance to be ascribed mainly to the wide avenues which separated the sheds, and to the large space allowed to the implements.

On Friday, the live stock and implements gaining prizes were again exhibited, when an unusual number of spectators, admitted at 1s., visited the yard, which was open to the public only from nine till one. In the afternoon, the trial of the reaping-machines took place on the farm of Liberton Mains, to which we have alluded in another part of this report. The horse-rakes and potato-digging machines were tried the same afternoon. On Saturday, the removal of the implements commenced in earnest, and was continued for some days after. We are glad to hear that a good many of the prize implements and machines were sold, and not a few of the animals changed hands at good prices to the sellers. Upon the whole, the weather was favourable; for, though we were visited by some showers on each day the exhibition was open to the public, and a heavy gale of wind occurred on the Sunday after the implements had been placed, and before the Judges commenced their duties, no damage was done, and the great body of visitors bent on sight-seeing and intent on examining everything, did not appear to be inconvenienced by the showers, from which some took shelter under the sheds in the vacant stalls. As no previous show of the Society had ever been honoured by a visit from any member of the Royal Family, it is worthy of notice that the Prince of Wales did the Society this honour by appearing in the Show-yard on the Wednesday and Thursday, on both which days he remained a considerable time; and, having ridden over the yard, stopping at the principal points of interest, examining the animals and implements, he dismounted and walked among the implements and machines, giving them a more

minute examination, and observing them at work. On the Thursday he was most enthusiastically received by the thousands congregated in the yard.

It will not be uninteresting to give here a note of the number of stock, implements, &c., exhibited at the General Shows of the Society since their commencement to the present time :—

NUMBER OF CATTLE, &C., SHOWN AT GENERAL SHOWS.

Locality.	Date.	Cattle.	Horses.	Sheep.	Swine.	Poultry.	Total.	Dairy Produce.	Implements.	Premiums.
1. Edinburgh,	1822	59	...	8	...	...	67	...	...	£78
2. Do.,	1823	44	...	77	12	...	133	...	..	110
3. Do.,	1824	62	...	89	5	...	156	...	...	105
4. Do.,	1825	42	...	43	7	...	92	...	...	110
5. Glasgow,	1826	226	49	148	24	...	447	...	...	186
6. Edinburgh,	1827	44	...	138	6	...	188	...	11	224
7. Glasgow,	1828	302	42	112	69	...	525	...	30	277
8. Perth, . .	1829	192	52	199	13	...	456	...	13	357
9. Dumfries,	1830	180	60	247	19	...	506	...	18	353
10. Inverness,	1831	198	90	129	11	...	428	...	4	318
11. Kelso, . .	1832	88	18	243	16	...	365	...	11	530
12. Stirling, .	1833	288	74	160	54	...	576	...	22	553
13. Aberdeen,	1834	188	77	192	58	...	515	28	9	627
14. Ayr, . .	1835	309	70	324	46	...	749	43	29	576
15. Perth, . .	1836	265	46	416	18	...	745	6	17	479
16. Dumfries,	1837	181	77	512	14	...	784	31	36	650
17. Glasgow, .	1838	461	121	274	47	...	903	39	62	731
18. Inverness,	1839	302	93	445	43	...	883	...	24	744
19. Aberdeen,	1840	269	80	126	69	...	544	46	30	781
20. Berwick, .	1841	175	96	658	33	...	962	..	60	1050
21. Edinburgh,	1842	295	179	487	53	...	1014	38	200	1200
22. Dundee, .	1843	317	73	324	30	34	778	31	101	990
23. Glasgow, .	1844	558	210	568	64	50	1450	277	357	1600
24. Dumfries,	1845	297	75	537	62	101	1072	88	143	900
25. Inverness,	1846	428	112	357	33	76	1006	23	59	1050
26. Aberdeen,	1847	361	105	230	24	102	822	42	49	920
27. Edinburgh,	1848	351	142	760	58	128	1439	165	310	1153
28. Glasgow, .	1850	484	164	639	85	172	1544	316	577	1359
29. Perth, . .	1852	313	135	662	50	186	1346	123	339	900
30. Berwick, .	1854	179	141	771	86	264	1441	...	357	1500
31. Inverness,	1856	248	131	469	43	156	1047	...	231	1000
32. Glasgow, .	1857	415	240	669	112	429	1865	234	610	1500
33. Aberdeen,	1858	450	189	590	79	366	1674	...	802	1500
34. Edinburgh,	1859	332	188	583	80	327	1510	54	980	1500

The first Show in 1822 was one of fat stock, and was held in the inclosed area behind Queensberry House in Edinburgh. The immediately succeeding three Shows were also held in Edinburgh, and were for fat stock, as were the Glasgow Show in 1826 and the Edinburgh one the year after, with the addition of a few premiums for breeding stock. At all of these, implements and seeds were exhibited, though no premiums were offered for them. The Society had for many years previous to the holding of these Shows in Edinburgh and Glasgow encouraged local Shows, by offering premiums for the improvement of the native breeds. The first General Shows, which we have said were for fat stock, were tried as an experiment

in imitation of those long held in England, and, as it were, to test the improvement made in the native breeds by the practice the Society had so long followed, of offering premiums for that purpose at the local Shows. It was at first determined that the Shows "should be held triennially and alternately at Edinburgh and Glasgow, and in the intermediate years at some other town or city to be fixed on. The applications, however, were so numerous and urgent for having Shows in different parts of the country, that the Society yielded to the wishes so generally expressed." It will be observed, then, from the above table that there was an annual Show at different towns up to 1848, when the Society, on the recommendation of the Directors, who were forced to make this recommendation from there being no applications from any district for the Show, on account of the great depression in agriculture which prevailed about this period, resolved that the Shows should henceforth be held only triennially. A strong feeling of dissatisfaction, however, was expressed against this change by some of the members, through whose exertions the interval of holding the Shows was reduced from three to two years till 1856, when they again became annual, and are now held in Edinburgh, Glasgow, Perth, Aberdeen, Inverness, Dumfries, and Kelso, representing the districts in which they are situated. We may mention that one of the reasons of the Show becoming annual again is the greater facility with which the money is obtained for the support of the Show by voluntary assessment. Besides the General Shows alluded to in the foregoing table, two Shows of fat stock were held in Edinburgh and Glasgow in 1853 and 1854, after which they were discontinued from want of support, and through the consequent loss the Society sustained from them.

By referring to the table, it will be seen that the total entries of live stock do not equal those of the two previous Shows, or of that held in Glasgow in 1850. This deficiency must be attributed to the new arrangements which have been introduced this year in accordance with the suggestions contained in the Report by Committee on General Shows; and on this account a fair comparison cannot be made between the Show of this year and those of previous years, as it must be regarded experimental or tentative of these suggestions. Let us inquire for a little as to how these suggestions of the Committee, when carried out, affected the Show. Formerly the stock was placed, judged, and exhibited on Thursday, and the prize animals were shown on Friday forenoon. At the late Show in Edinburgh, agreeably to the Report of the Committee, the stock was placed on Tuesday afternoon and Wednesday morning, judged on Wednesday morning and forenoon, and exhibited to the public on Wednesday afternoon and the whole of Thursday, the prize animals being shown again on the forenoon of Friday, as formerly; in short, the exhibitors are obliged to keep their stock at least one day longer in the Show-yard than formerly.

The necessity for having shedding for the stock was thus involved in this new regulation. Thus considerable additional expense is entailed on the exhibitors—1st, for the use of the shed-accommodation ; 2d, for the keep of the animals ; and, 3d, for the servants in charge of the stock, besides the loss of their time at home. Now, formerly a good deal of stock was entered, not so much in the expectation of their gaining premiums at the Show, as of their being sold there, and thus many animals where exhibited whose presence there could scarcely otherwise have been accounted for. The additional expense of exhibiting caused by the new regulations prevented, we have no doubt, many such animals from being brought forward at the late Show ; and hence it was a general remark of the best judges that the stock exhibited was more select than formerly, the general character of it being very superior to that of previous Shows. We have heard some exhibitors complaining of their being compelled to pay for shed-accommodation for their sheep which were never under a roof at home, and did not require it in the Show-yard. We may observe that the charge for sheds was only about one-half of what was paid by the Society to the contractor; and without expressing any opinion as to the justness of this complaint, we will simply state what we heard from an exhibitor of blackfaced sheep, which were so little accustomed to confinement or shelter of any kind, that they scarcely tasted any meat in the pens, so opposed was their lodging in the Show-yard to their usual habitat in the hills. This exhibitor mentioned in the course of conversation, that he considered the shedding the greatest improvement introduced this year in the arrangements of the Show ; for his sheep were sheltered in their confinement from the sun, which was often very strong at the season of the year at which the Show was held ; and if the weather happened to be wet during the Show, if there were no shedding, from the sheep being confined within a very limited space for two days and one night at least, the soil within the pens, the only place they had to lie on, would be reduced to a perfect puddle. It is to be remarked that the great falling off in the numbers of the stock entries is in the sheep, there being 177 fewer entered this year than at the Show held in Edinburgh in 1848. There is little difference in the cattle, there being only 19 more in 1848 than in 1859. There were 46 more horses, 22 more swine, and 199 more poultry in 1859 than in 1848. Upon the whole, there were 71 more entries of stock in 1859 than in 1848. The show of implements was less affected by the new regulations than that of stock ; and hence we had the largest exhibition of machinery implements ever held under the auspices of the Society, there being 178 more entries there than at Aberdeen, where nearly 200 more implements were exhibited than at any previous Show, owing very much to the Show being held at a different time from that of the Yorkshire Society,

whose time of meeting being held contemporaneously with the Highland Society's Show, has of late years interfered materially with the exhibition of implements at the latter, as the English implement-makers, anxious to obtain customers both in Scotland and Yorkshire, divide their entries between the two Shows.* A most interesting history of agriculture could be compiled from an analysis of the exhibitions of implements at the Society's Shows from 1827 to the present time; but our space does not admit of our entering upon this at present.

LIVE STOCK

is the most important, as it generally is the most popular, part of all agricultural shows, the main object of which is the improvement of all classes of animals exhibited. And this improvement supposes the solution of the following problem:—To produce an animal or living machine which, with a certain quantity and quality of food, and under certain given circumstances, shall yield in the shortest time the largest quantity and best quality of beef, mutton, or milk, with the largest profit to the producer, and at the least cost to the consumer. We have not included the production of wool in the above, because, though for some years back it may have been even more profitable than the production of mutton, it is by no means of such vital importance to the people of this country as the production of food. It must be admitted that the solution of this problem requires no small amount of talent—we would even say genius—skill, experience, patience, perseverance, and time. And those who have been successful are well worthy of that honour which has been freely bestowed on them by their countrymen. In no country of the same extent is there greater call for the exercise of these qualities than Scotland, where the variety of configuration of its surface, and the differences of climate, demand a great variety of breeds, each of which nature has adapted to its peculiar situation and circumstances, and which it is the part of man, keeping this adaptation in view, to improve. Wisely, then, have the Directors of the National Agricultural Society of Scotland, while giving due importance to the improved breeds, such as the short-horns, not natives of Scotland, but admittedly superior to other breeds, *cœteris paribus*, offered equal encouragement to the improvement of the native breeds, which must ever remain the foundation of the prosperity of the farmers in the greater part of Scotland, and ought not to be sup-

* We need not enter into the details of the correspondence between the Directors of the Highland Society and the Council of the Yorkshire Society, the results of which were reported in the account of the Berwick Show. Since then negotiations were renewed between the two Societies, which proved as fruitless as the former ones. And after a due consideration of all the circumstances, we must say that the Directors of this Society must be exonerated from all blame in this matter by every unprejudiced man.

planted by short-horns, or other improved English breeds of the present day. And hence the Show-yard of the Highland Society presents a greater variety of aspect than that of any other national society. All the native breeds were well represented in Edinburgh, and, as we stated before, it was generally admitted that the show of stock was, upon the whole, superior in character to most of the former exhibitions of the Society.

HORSES.

"Well may the Scotch be proud of their Clydesdale horses," was the remark of an English gentleman beside us in the trial-field at Myreside, on the principal day of the trial of implements, as he stood admiring the fifty teams of horses prancing past us, taking up their position in the field, and being yoked, moving off with ease—pictures of strength, activity, and docility. Next day, about 175 specimens of the same breed of horses, gathered from all parts of Scotland, were exhibited in the Show-yard, and met with the admiration of thousands of spectators.

Stallions.—For some years back great difficulty has been experienced in getting good stallions. The principal reason of this is the great exportation to the Continent, Australia, and other places, of the best animals, for which large sums were offered to the breeders, as an inducement for them to part with them. We cannot but express our regret that too often they yielded to the temptation held out to them, thus pursuing a suicidal policy for which both they and the country are now suffering. Very different is the practice of the great breeders of cattle and sheep, who consider it unwise to part with the best animals in their herds and flocks on any consideration. A good show of Clydesdale stallions, then, either at the Highland Society's Exhibition or elsewhere, has been very rare for some years back; and members of local societies have resorted to all kinds of expedients to endeavour to obtain good stallions to improve the breed of horses in their districts, but in vain; and this want of success is due to the simple fact that the description of stallions that used to be exhibited a few years ago is not in the country at present. The horses at the Edinburgh Show were no exception to what we have stated. Most of them exhibited were unworthy of any prize, and even those gaining the prizes were not what would be considered first rate. The grey horse which carried off the first premium appeared well suited for getting horses for brewers and those in towns who require large horses for carting; and though no doubt such horses may bring high prices, they are not considered the best for breeding horses for farm-work, for which purpose there were other horses shown far better adapted. The first horse had certainly bulk in his favour, but most farmers considered him too long in the legs, slack in the back, with a want of middle.

Three-year-old Entire Colts.—This was decidedly the best show

of entire horses in the yard. There was not what would be considered an inferior animal, or one that would not do credit to the breeder. It is some satisfaction that we can look forward to having some really useful stallions for some years to come, if they are not bought up and sent out of the country. The first-prize horse in this section is one of the best ever shown at the Society's Exhibitions; it gained the prize for the two-year-olds at Aberdeen last year, and it has improved very much since then.

Two-year-old and Year-old Entire Colts.—These two classes were by no means equal to the three-year-olds as a class; but it is unfair to judge them too severely, as improvement is always looked for as they grow older. The year-olds were the worst class of entire colts, and the two best-looking in the section were cast on account of unsoundness, the Judges and Professor Dick being of opinion that the cause of unsoundness would be hereditary.

Mares, with foal at foot, were very good, but as a class were not superior to those shown in former years. The grey mare gaining the first prize was considered by every one as well worthy of it. She was very neat, well proportioned, with flat bones, and no redundancy of hair on the legs. Mares in foal, as might be expected, looked much better than the former section of mares, and in reality were, as a class, superior.

Fillies, three-year-old, two-year-old, and year-old, were very superior, and were considered by the Judges the best in these classes ever brought into competition at the Society's Shows. The Judges had considerable difficulty in awarding the premiums in the three-year-old and year-old classes.

Extra Horses.—On this section we have little to remark, as there was nothing either very excellent or very attractive in it. The stallion Lord Fauconberg, though respectable as a thorough-bred horse in Scotland, would hold but a secondary place in England. The thorough-bred mare of George Stenhouse, showing considerable substance and symmetry, as well as the very handsome Shetland pony, are worthy of notice.

CATTLE.

Short-horns.—These are deservedly placed first in the premium-list of any Society whose object is the improvement of the breeds of cattle and sheep in a country. For there is no other breed on which the same thought, care, and expense have been bestowed; no other on which the same successful application of physiological principles has been made; no other in which such triumphant results have issued from intuitive knowledge, well-directed thought, and judicious management. No one could have predicted such extraordinary results when, nearly a century ago, two farmers were observed critically examining and ultimately purchasing a poor man's calf which grazed in a by-lane on the banks of the Tees. To this

calf, which afterwards delighted in the name of "Hubback," is traced back the pedigree of that breed which now commands the admiration of the civilised world, and has proved as useful to the overflowing population of its native country as remunerative to its possessors. We are not writing a history of the breed, and therefore we will not stop to inquire as to whether it is descended from Holland cattle, or as to the advantages or disadvantages of the "alloy," or to mention some of the fabulous prices obtained for individuals of the breed. We would rather make a few remarks on its value to the Scotch farmer.

The improved shorthorns are possessed of a hardy constitution, and excel all other breeds in their early maturity, and in carrying on their growth with their condition—a most valuable quality. But we ought always to bear in mind that they are natives of a country which differs from Scotland in its climate; and though that difference may not be great, it is sufficient, we believe, to produce a marked change on any animals imported from the native country of the shorthorns into the greater part of Scotland, unless additional expense and care were bestowed on them during their residence in the latter country. And hence we question whether it would be possible to form and maintain in Scotland distinct herds of improved shorthorns without the animals losing some of that fineness and other excellent characteristics of the breed, unless the Scotch breeders resorted to England continually to purchase animals to keep up these qualities. If it can be accomplished, it can only be at a greater expense to the Scotch breeder, who will require, at the same time, to bestow more care on his herd in feeding and sheltering them. The success of our Scotch breeders, such as Barclay, Cruickshanks, Douglas, Stewart, &c., is therefore more creditable to them, as it is success under difficulties, even though they are obliged to keep up the character of their herds by importations from England. The value of pure shorthorns to Scotch farmers generally, is for crossing with their native breeds; and here purity of blood and fineness of points is as necessary, because as profitable, as if pure herds were to be kept. They are used principally for producing crosses for feeding; but we see no reason why they should not also be used for producing crosses for giving milk. It is generally thought that improved shorthorns are bad milkers; but this is the fault of the breeders, not of the breed. It has been their anxiety to develop the fattening, to the neglect of the milking qualities of the animals, and to bring them forward at the Shows in such condition as to prove their aptitude to fatten. The originals of the improved shorthorns were noted milkers; and that the two qualities are not incompatible in the same animal, we have abundant evidence from the fact of one of the most celebrated herds of the improved breed—viz. that of Mr Bates—possessing also milking properties; and from the cows in the London dairies, many of which are almost pure

shorthorns, being valuable for the dairy, and at the same time having great aptitude to fatten. By the proper selection of those shorthorn bulls, whose progeny were good at the pail, and crossing some of the milking native breeds with him, an animal would be obtained which would retain the milking properties, be more easily fattened when of no further use in the dairy, and attain a larger size than the original native breed; and such an animal, we have no doubt, would be found far more valuable in our town dairies, and on most of the low country dairy farms. If wished, the crossing may be carried back to the pure shorthorn breed; but, for general purposes, we believe that the first cross will be the most profitable. We need not remark how valuable the shorthorn is to the Scotch farmer for crossing with his native breeds to produce grazing animals. It improves for fattening every breed it crosses with. This is universally admitted.

The character of the shorthorn has undergone a considerable change during the last ten years; it has become more compact with shorter legs, and the beef is laid on with more levelness over the whole body, all the frame being equally covered over, and little or no coarse beef in the carcass, while the symmetry has been carefully attended to. This was very observable in the best animals shown at Edinburgh, which prevented the show of shorthorns, as a class, from being inferior to what has been exhibited at former meetings of the Society. The first prize bull (No. 8) was a massive animal, showing many good points, such as his loins, quarter, &c., but rather deficient in his fore-quarter; the second prize bull (No. 3) was superior to him in some respects, even in those points in which the first was best—viz. his loins; in these the second bull was perfect. The third bull (No. 10) has been frequently successful this season, is a massive animal, with many good points about him. The aged bulls were decidedly superior to the young classes, which contained no animal of special merits. The best show of the shorthorns was in the cows and two-year-old heifers, which are much indebted for their excellence as a class, to the superior character of the animals exhibited by Mr Douglas, in which were manifest that purity of blood so characteristic of all Mr Douglas's stock. The first-prize cow (No. 47) is of the Booth blood, has all the characteristics of the high caste shorthorn for perfect symmetry and heavy flesh; her head is perfect, and the flesh well laid on her loins. The three prize animals in the two-year-old heifers were bred by Mr Douglas, who is the owner of the first two. The first-prize heifer (No. 61) is of the Booth blood of the Bracelet and Hawthorn Blossom tribes, and is of the same style as the first cow, and is, we believe, a daughter of the cow which carried the first prize at Aberdeen. The second-prize two-year-old heifer (No. 62) is also a beautiful animal, showing the effect of combining the Bates and Booth blood of which she is an admirable example.

POLLED CATTLE.

Angus or *Aberdeen.*—This breed of cattle has lately attracted more attention, both in this country and on the Continent, than any of the other native breeds of Scotland. Their massive frame, hardy constitution, quiet disposition, aptitude to fatten, and excellent beef, have tended to recommend them to the notice of breeders and feeders in these countries. We have here, as in the shorthorns, a striking example of what can be done in the improvement of a breed by careful selection and judicious management; for there is as great a difference between the original and the improved Angus and Aberdeen polled as between the original Teeswater and the improved shorthorn. There are some who allege that the improved Angus are indebted for many of their fine points to the shorthorn, which they may be said to rival in these points. Though there may have been one cross with the shorthorn at the commencement of the improvement, we see no greater objection in mingling the blood of a shorthorn with that of a pure Angus than in mingling the blood of a Galloway with a pure shorthorn, as was done by Colling at the commencement of the improvement of the shorthorns. On the contrary, an improver of a breed is to be commended who succeeds in engrafting the superior qualities of an improved breed on a native breed without destroying the good qualities of the latter, and who by this cross produces animals stamped with such unvarying characters as to constitute them a distinct breed. Fortunately, we are not left to mere conjecture as to the origin of the improved Angus cattle, and we think a short account of the history of their improvement here may not be uninteresting. Mr Watson, Keillor, commenced as a breeder in 1810, now nearly half a century ago. At this period the doddies were highly valued by the English dealers who then came into Forfarshire annually as well as into Dumfries and Kirkcudbright shires, to buy up grazing cattle to be fed off in the southern counties of England, particularly in Leicestershire and the county of Norfolk, where they were known under the general name of Galloway Scots. It was about this period that the great improvement in the Teeswater or improved shorthorns began to attract the attention of Scotch breeders of stock; and such was the success of the first improvers of this valued breed on the Tees that the eyes of nearly all the breeders in Scotland were directed to them, and the prices given for pure bred animals became almost fabulous. In Forfarshire no very fixed principle had hitherto operated towards the improvement of the native breed of doddies; yet they were decided favourites in the markets, both as dairy and grazing stock, their habits being more quiet and docile than the horned breeds of the Highlands. Such was the superiority attributed to the shorthorns for inclination to fatten at an early age, and the unquestionable improvement effected by crossing the native cows of every breed with the shorthorn bull,

that in the course of a very few years almost every breeder in Forfarshire had taken to crossing, and given up the old doddies. Having by this time made a selection of the best Angus cows he could procure from the most celebrated breeders of the day, and secured several bulls with various points suited for improvement of a general herd, Mr Watson set to work, keeping in mind and acting on the great and judicious principles laid down by those breeders who had been so wonderfully successful—viz. the Bakewells, Collings, and the other Teeswater breeders, with some of whom he had the good fortune to come into personal contact, and from whom he received the most valuable hints and kindest encouragement to proceed in his endeavours to improve what they reckoned (next to the West Highlander) the most valuable breed of cattle that Scotland produced—a breed which these practical men considered it would be a national calamity to lose. Persevering with much anxiety, and with varied success, in experiments to improve the feeding qualities of his herd, and develop the best points (taking as his model the improved shorthorns), he had the satisfaction to gradually find, by the demand which his Keillor doddies now commanded, the fancy prices he occasionally obtained, and the interest they were exciting over the kingdom amongst those best able to judge, that his exertions had already met a generous reward. He then resolved to hold an annual sale by auction of such animals as were suited for breeding; these sales brought purchasers from all parts of Scotland, and occasionally from England and Ireland. The fame of the Keillor improved doddies being established, the sales by auction were given up, and the demand by private bargains was quite equal to all the supply.

During the progress of improvement, every opportunity was taken of entering into public competition both at the Local Societies of the county as well as the National Societies of the United Kingdom. The result was upwards of 200 prizes during 20 years as an exhibitor, some of them accompanied with very gratifying remarks by the Judges who awarded them. We may adduce the following as examples:—

In 1829, after gaining the Highland Society's premium for extra stock at Perth, a heifer (whose dam had a strain of Guernsey blood) was again shown in London, same year, at the Smithfield Show, and had a medal struck off for her, at the request of the late Earl Spencer, then president of the Society, who took great interest in the improvements of the Keillor herd. The Judges stated, in reporting their notice of this animal, "that in their opinion she was nearer the point of perfection than any animal ever shown at Smithfield."

A few years after, a four-year-old ox, shown at the Royal Irish Improvement Society Show at Belfast, after gaining the first prize for any breed, had the Purcell Challenge Cup awarded to him as the best animal in the yard; but not being a *perfect* animal that could perpetuate his breed, the prize was given over to the best short-horn cow. This ox was afterwards shown at Smithfield as the property

of H.R.H. Prince Albert, and became a favourite of Her Majesty the Queen. He died in consequence of an accident at the age of 18. His dam, one of the earliest specimens of the improved Angus doddies, died 1st July last, at the extraordinary age of 35 years and 6 months, having bred 25 calves, all of which were prize animals, and has left a strain of her blood in every animal now in the Keillor herd. The old cow was, when in her bloom, a perfect specimen of her breed, showing wonderful vigour of constitution, combined with extraordinary fattening qualities and fine points.

Mr Watson has now retired from public exhibitions, but has the satisfaction at every show of tracing the blood and family characteristics of his breed—amongst the first prize animals of the day—and rejoices to see they are now in hands likely to improve and perpetuate them, as was manifested at the late meetings of the Highland and Agricultural Society at Aberdeen in 1858, and lately in Edinburgh, where the exhibition of this class created great interest. Since the retirement of Mr Watson, the reputation of the doddies has been fully maintained by Lord Southesk, and Messrs M'Combie, Bowie, and others, with their improved polled Aberdeen cattle, with the authentic history of which we are not at present furnished

The show of polled Angus and Aberdeen at Edinburgh was decidedly a good one; indeed it has been rarely surpassed. The first-prize aged bull, the prize cows, and the first-prize two-year-old heifer, were as perfect animals of their kind as any to be seen in the yard. The excellence of these animals, and generally of those competing against them, contributed materially to the superiority of the Edinburgh Show over some of its predecessors. Where all were so good, it would be invidious to select any specially for notice more than we have done. We will simply state that the best class was that of two-year-old heifers; these have never been equalled at any previous Show. Our Scotch breeders will require to be on the alert, as one of the prizes goes to England and another to Ireland.

GALLOWAYS.

The fine skin, less hair, thinness of shoulder, finer head and neck, and better-developed hind quarters, distinguished the Angus and Aberdeen from their congeners the Galloways. The difference of coat and skin in the two breeds is adapted for the different treatment to which each is subjected; the Galloways being far more exposed to the weather than the Angus, which are generally more kindly feeders. The show of Galloways was upon the whole good, fully an average. As a class, the two-year-old heifers were the best, the aged bulls the next, and the cows were fair; the year-old bulls were rather deficient in quality, but they may improve.

AYRSHIRES.

Upon the whole, the show of this breed was not equal to those of

former years, though there were animals exhibited seldom equalled, and certainly not surpassed on any former occasion. There was a decided improvement in the size of the animals, which may be attributed in some measure to the remonstrance held forth by the Directors at the Show in Glasgow in 1850, against the breeding of such diminutive animals as were there exhibited. "It is to be feared," said the Directors in the Report of that show, "that the Aryshire milking stock of late years has been bred to too light weights—a delicate appearance and well-set udder being the points most aimed at. These points have been attained by the practice of starving the young heifers, with the supposed object of making them good milking cows; but a good milker it is apprehended, will not be formed by any such negative means. An improvement, it is believed, would be effected in both points, were the heifers bred so as to attain heavier weights and greater substance; and on becoming cows they would then not only prove greater milkers, but might easily be fed a hundredweight or two heavier. The paramount object to be held in view in breeding Ayrshires, is obviously to obtain the largest quantity of good milk, with a tendency to fatten when put up to be fed; and neither of these ends will be attained by light weights and delicacy of appearance."

The first-prize aged bull was remarkably good in the head, neck, and shoulder, well topped and ribbed, with fine bone. The second-prize one possessed in an equal degree the excellent points in the head, neck, and shoulders, and was as well topped; but he was deficient in the rib and thigh, and when walking, threw his hind feet too much under him. As a class the two-year-old bulls were inferior. The bull which gained the first prize in this class was only a year old, and on this account appeared undersized to those who were not aware of the fact; he was rather deficient in the thigh, but good otherwise.

The first-prize cow in milk was perhaps one of the best specimens of an Ayrshire cow to be seen. Possessing all the characteristics of a good dairy cow, she has combined in her an amount of fine breeding and substantialness rarely to be met with in that class of cattle. With the exception of the hind teats, which might be slightly improved, she may be pronounced a perfect animal of her kind. The first-prize cow in calf, though not equal to the former in point of fine breeding, was nevertheless a superior dairy cow. She possessed great length and breadth of vessel, and the formation and position of the teats were perfect. The other cows in the respective classes, though good, were far inferior to these. The two-year-old heifers were not equal to the cows. The first-prize year old heifer was very highly bred. The head, neck, shoulders, and back, were perfect, but she was rather deficient in the thigh.

HIGHLAND.

The month of August is too early for seeing the West Highlanders in their glory; and while, therefore, they were not to be seen at Edin-

burgh in perfection, the Show was, as compared with those of former years, fully an average. This is the more remarkable, as Edinburgh is rather out of the district of this kind of stock. The first and second aged bulls were first-rate animals, and were well criticised by the visitors. Some of the prize animals were remarkable for the breadth of their shoulders, the depth of chest, and the long broad-shaped horns; while others were rather narrow across the loins, short in the quarters, and were rather bare of hair, which is a great fault in a West Highlander. Some of them had bad houghs, which detracted much from their appearance, and gave them the look of weakness.

EXTRA CATTLE.

Most of the animals exhibited in the different sections of cross-bred stock might have been taken as fair specimens of short-horns, which shows the estimation in which that improved breed is held for crossing with other breeds. One of the Judges in this class writes to the Directors:—"Allow me to suggest for your consideration that greater encouragement should be given in prizes for the breeding of crosses. My reason for writing this is, that they are more suitable for many forms than the short-horn; also good crosses at 2½ and 3 years old will make as great weights and worth more per stone in the fat markets than a second class short-horn; and at the first they are much more easily obtained in a pecuniary point of view and otherwise than the short-horn." This agrees with the opinion we formerly stated, that the improved short-horn is more valuable to the Scotch farmer for crossing with his native breeds than for keeping as the ordinary stock of the farm. Several questions will have to be considered, if the prizes for crosses are to be extended, such as what degree of cross is the most profitable, the first, second, or third remove from the pure breeds? Are separate prizes to be offered for each remove? &c. The animals most worthy of notice in this class were the cross-bred heifer, No. 297, and the ox, No. 314. Upon the whole, the cross-bred class could not be considered as equal to that at Aberdeen last year, though some animals, such as No. 314, were superior to any shown there.

The three-year-old polled ox of Mr M'Combie was a magnificent animal—one of the best in the yard. There was considerable room for improvement in his two-year-old polled, though also a very good animal.

We have seen better shows of Highland oxen than that of this year, and we do not think that any of the animals exhibited call for special remark.

Amongst the extra cattle we observed Mr Douglas's cow, "Ringlet," which gained the first prize at Aberdeen last year; and, besides, there were two heifers, crosses between the short-horn and West Highland, two admirable animals of the kind.

SHEEP.—LEICESTERS.

The Leicesters hold the same position among sheep as the improved short-horns do among cattle; and most of the remarks that we have made regarding the latter are applicable also to the former. In tracing the history of the improvements of the long-horns and Leicesters by Bakewell, and of the short-horns by Colling, we observe that the same course was pursued, and the attention of the breeders was directed to the same points. The first step taken by both of them was to reduce the size of the original breeds. The old Leicester was large, heavy, coarse-woolled, long and thin in the carcass, flat-sided, with large bones and thick, rough and white legs. The wonder is, how any man could have produced such a metamorphosis as to transform the old into the new Leicester. But, though the same steps were adopted for improving the old breeds of short-horn cattle and Leicester sheep, the latter, since the death of the original breeder, have undergone far more changes in the hands of subsequent breeders than the former, though the flocks are of equally pure blood, and can be traced up to the Bakewell flock. The breeders of the Leicester appear to have impressed on their flock their thoughts, by developing certain points which they conceived to be best; and thus a diversity of tastes among the breeders has produced such a difference of appearance in their flocks as to make a stranger suppose that they were different varieties. There can be no doubt of their being of the pure Bakewell blood, for the law of caste has not been more religiously observed in India, among the Hindoos, than it has been among the principal breeders of the new Leicesters during and since Bakewell's time. The rigid rules of the Dishley Society, organised by him, prevented the mingling of any impure blood with the first flocks, and introduced a love and respect for purity of blood, which has been a *sine quâ non* with succeeding breeders. The new Leicester being, as we said, much more impressible to foreign influences than the improved short-horn, climate has a marked effect upon it, to such a degree, as that one of the pure breed, taken from its native district in England and located in a district of the average climate of Scotland for a year or two, will be so changed as to be scarcely recognisable by the breeder of it, even though it may have been liberally supplied with food. The climates of England and Scotland then may be said to have made two varieties of Leicester, the English and Scotch, both of which have their admirers.

To the great majority of Scotch farmers the use and value of the new Leicester is for crossing with his native breeds, a system which, if judiciously carried out, will be found to be more profitable than the keeping of pure flocks of Leicesters in Scotland. There was a very good show of this breed, particularly of the gimmers. There were so many first-rate animals in all the classes, which were so little inferior to those that got prizes, that there would have been a

great number of commendation-tickets had the rules of the Society allowed it. The Judges suggest that, if possible, some check should be put on the practice of over-feeding breeding ewes. One lot, we believe, which was deemed worthy of a prize, was set aside, because there was a certainty of their never having bred. The system of partial clipping was also very evident in some instances, and ought to be prevented if practicable. Both the English and Scotch Leicesters were well represented; the former by Mr Wiley's sheep, the latter by Mr Cockburn's. So wide is the difference getting between these two varieties, that the decisions will be regarded ere long as capricious, depending very much upon the tastes of the Judges, whether they be in favour of the English or Scotch variety. It would be well if this matter were considered when the question of general shows is again taken up by the Society, which will be called upon to indicate whether purity of blood, combined with small size and delicacy of constitution, is to be the ruling element in the decisions. As there were so many excellent animals, between which there was little difference, we think it better not to single out any for special remark.

CHEVIOTS.

These were well represented by healthy, hardy-looking animals, which we were glad to see, as the unfortunate experiment made by some farmers, to infuse into their mountain stock, tended very much to produce a delicacy of constitution most unsuitable for the climate of the Scottish hills. The show of Cheviots has never been surpassed in any former year. The aged rams, the ewes, and gimmers, were decidedly the best classes; in all of which there were some very fine lots. The Judges experienced considerable difficulty, from the great equality in the animals, in awarding the premiums in the aged ram class. The dinmont class contained some rather inferior animals.

BLACKFACED.

The show of this breed was fully an average; though there were defects in the ram class that should be taken notice of. There was a want of growth about them; short in the bodies, with small bones, and the horns too high set, and placed too near in the head. The same faults seemed to prevail in the gimmer class; and, though there were some ewes there that ought never to have been brought forward, the three premium lots were good animals, possessing the points in which the rams were deficient: they were growthy, with good bone, and low, wide set horns. We think those breeders are acting a wise part who are not carried away with the present rage of substituting cheviots for blackfaced in districts where success is very questionable.

SOUTH DOWNS.

This was one of the best shows of this valuable breed which has been held in Scotland since Mr Jonas Webb and Mr Watson have withdrawn as competitors. The number of entries was increased and the quality was magnificent. The sheep exhibited by the Duke of Richmond, from his Sussex flock, were the great ornament, not only of the South Down portion of the yard, but were, we may say, one of the chief attractions of the Show. The Society and the public of Scotland at large are greatly indebted to his Grace for bringing before their notice the perfection to which this breed can attain by skill, good keep, and management. The three-shear ram winner of the first prize here, as at the Warwick Show, has been generally admitted to be as perfect a specimen of the South Down as ever existed. Like all the Goodwood flock, the face and legs are of an equal, light, soft, silvery grey; the head beautifully covered with wool, and the whole fleece admirably close and fine in quality. The climate of the south of England, combined with the practical skill of the shepherd, have produced those perfect animals, which are marvels to the Scotch breeders and shepherds. Mr Aitchison, of Alderston; Mr Hutchison, Monyruy, and Mr Scot Skirving, Camptoun, with some of the Duke of Richmond's stock, took the remainder of the premiums. Amongst the stock of these gentlemen were some first-rate animals for a cold climate, and it was no disgrace to them to be beaten by the Goodwood animals. As an instance of the excellence of this show of South Downs, we may mention, that a ram of Mr Skirving's, which gained the Society's first prize, as a shearling, at Aberdeen last year, and also the first prize in its class this season, at the Show at Dundalk, did not find a place in the premium list of the Edinburgh Show. This breed is becoming a formidable rival for crossing ewes of different kinds for early lambs; but we think that the climate is too damp for there ever being many pure-bred flocks of them in Scotland. We have a practical proof of what climate can do in part in the Goodwood flock, as compared with all the others exhibited at Edinburgh.

LONG-WOOLLED SHEEP OTHER THAN LEICESTER.

The only kind of sheep exhibited in this class were Cotswolds. It has for some time been a complaint with breeders and feeders that, though they have always early maturity in the crosses from the Leicester with the native breeds or half-bred stock, they do not get the weight. They have, therefore, turned their attention towards the Cotswolds, which have both early maturity and size combined. The size and weights to which the Cotswold teggs or hoggs attain, when they are fat and ready for the London market, are quite surprising; and it is on this account that some of our Scotch breeders are now

looking to them for crossing with their ewes to produce fattening sheep. The size and symmetry of the rams exhibited gained the admiration of multitudes of the spectators, and opened the eyes of practical men as to the properties of this breed, which has been entirely overlooked in Scotland. The ewes were by no means equal to the rams.

SWINE.

We have several times seen much better shows of swine than this, both in point of numbers and in quality, though the prize animals were certainly good.

POULTRY.

This is the worst time of the year for the exhibition of poultry, of which the show cannot therefore be expected to be good, either for numbers or for quality; for people who possess good poultry are not inclined to send them out when they are moulting. It would be much better, therefore, if poultry are to be exhibited in summer, that chickens should be included in the Show; this would give an additional interest to this part of the Show. The show of Dorkings was capital for the season of the year; indeed, the show of all the different kinds but the Spanish and game was considerably above an average. We regret to find so few entries in this class from tenant farmers, which argues an indifference on their part to an important part of the stock on their farms. When we consider the large sums paid by this country for eggs and poultry to the farmers in foreign countries, we are the more surprised at this indifference. For if about 122,000,000 of eggs are imported and sold in England yearly, at a price which must remunerate the producer (otherwise he would not continue to send them as he does every year in such increasing numbers), much more likely is it to pay the farmer at home who has not so much to pay for the carriage. The reason given for farmers having so little to do with poultry is, that they do not pay; but the reason why they do not pay is, they are generally considered by them beneath their notice.

BUTTER

was a very poor show indeed. The Judges did not consider any of the samples of powdered butter worthy of a premium. It is curious enough, that though the butter premiums were offered because a considerable part of the district of the Show was devoted to the making of butter, only about one-fourth of the entries for powdered butter, and not one-half of those for fresh butter, were from that district. We have often seen better exhibitions of butter at the shows of local agricultural societies.

IMPLEMENTS AND MACHINES.

The improvement in agricultural implements and machines during the last twenty years has been as remarkable as the demand has been astonishing. The rude implements, which were generally but few in number, formerly used even on the best farms in the kingdom, are now displaced by others constructed according to scientific principles, and after attentive observation and careful trials. Several circumstances have contributed to this improvement. The progress of agriculture, the diffusion of sound views both on its principles and practice, an improved education, begetting a love of inquiry among farmers, caused a want to be felt of implements and machines for the proper conducting of the operations on the farm. Nor were the manufacturers slow to perceive the advantage which accrued to them from such a change of circumstances—they consulted practical men, they improved, they invented, they even went beyond what the farmer thought was necessary, and though their exertions were dictated by self-interest, it is creditable to them to say that they not only tried to meet the wishes of the agriculturist, but they were eminently successful in doing so.

But their efforts would not have been successful, had not the national Agricultural Societies of England and Scotland, giving tangible expression to the feelings of their members, and of the agricultural community at large, offered premiums for the best and most improved implements and machines. Stimulated by the honour more than by the value of these premiums, and also by the demand increased, if not created, by the annual exhibitions of the Societies, the manufacturers threw their whole energies into the work. The result was soon apparent in the sudden bound which improvements in agricultural machinery made in their progress. Notwithstanding the effects of these exhibitions, we still meet with people who declare that no benefits result from them. We will not attempt here to disabuse any such of their false notions or prejudices, but will simply mention some of the principal advantages attending agricultural shows of implements, which we will do in the words of Mr James Howard, in his able pamphlet on "The Manufacture of Agricultural Machinery."—"The periodical gatherings of these societies being of a perambulatory character, landlords, farmers, inventors and manufacturers of all grades, were induced to travel at least once a-year into another world from that in which they had been accustomed to move, bringing the practices of different districts into comparison with each other, gradually introducing into all districts every implement of recognised utility, affording to the manufacturer an opportunity of collecting the practical suggestions of his farming friends, and exhibiting to the intelligent village mechanic the best examples of modern agricultural machinery; thus expanding his ideas and preparing him on his

return home to apply what he had seen and learned to the improvement of his own productions." We have a striking example of the benefit derived from such exhibitions in the extraordinary progress made in the use of reaping-machines since the great Exhibition of 1851, through whose means public attention was first directed to them since the abortive attempts made by the Highland and other Societies to get a good machine some years before. Up to 1851, so far as we have been able to ascertain, the only reaping-machine used for cutting the whole crop on any farm in Europe was that of Bell's, which was employed every harvest on the farm of Inchmichael, in Scotland. The exhibition of M'Cormick's and Hussey's in 1851 revived that interest in reaping-machines which had been excited from time to time in this country; and in the year following—viz. in 1852—it is said that 1500 of Hussey's alone were sold. In 1855 M'Cormick stated at the trial in France, that 2500 of his machines had been sold in that year; and Burgess and Key, up to this time, have sold 2000, and nearly 1200 have been manufactured of Hussey's and Bell's at the Beverly works, now belonging to the Trustees of W. Croskill, besides the thousands that have been made and sold by other manufacturers in this country, on the Continent, and in America. We could adduce, as another example of the advantage of such exhibitions, the improvements of the plough, and the prominent position held by Howard's plough in Scotland, which have been brought about mainly through the means of the exhibitions and the trials of the English and the Scotch national Agricultural Societies; but for which also the excellence of Hornsby's plough, now acknowledged as a rival of Howard's, would not probably have been heard of for some years.

Though the rapid improvements in the implements and machinery of agriculture have been mainly due to the exhibitions of the national societies, we question much if they would have been as great and as rapid if the principal agricultural implement firms had not seconded the efforts of the societies. These firms being composed of partners of intelligence and education, which enabled them to divest themselves more readily of prejudices, and having at command a large capital, adopted and carried out any improvements which were suggested to them at the annual Shows; which a local blacksmith, however willing he might have been, supposing him to have been convinced of the utility of the improvements, would have been quite unable to carry out. Another cause of this rapid progress in improved machinery is the adoption of the division-of-labour system by the principal implement manufacturers of England, in which respect they differ from those of Scotland. By devoting their undivided attention, and that of their men, to the manufacture of one or two classes of implements only, they endeavour to bring these to such a state of perfection as inventive talent, capital, and skilled labour can effect. It is especially worthy of notice here,

as showing what may be accomplished by a man without the advantages of education and capital, but with ordinary talent, observation, and perseverance, when he devotes his mind and time to the manufacture of one implement only, that the premium list of the Highland Society often shows the name of a working blacksmith placed before that of extensive firms, with every one of the advantages stated above, in a class of implements which the former has made his particular study.

The Edinburgh Exhibition was admitted by all parties to be decidedly the best show of implements and machinery ever held under the auspices of the Society, both in point of the numbers of articles exhibited, and the getting-up of them. We observed now and then some implements which appeared to be hastily and roughly put together. If this was done with the view of reducing the price of the articles, the makers laboured under a wrong impression, and they did what will ultimately operate against their own interest. Though the Society does not intend, by the awarding of its premiums, to encourage merely finely-got-up implements, whose defects are glossed over with paint, it makes good and neat workmanship an important element in the adjudging of the premium. It would be advisable were a little more time allowed for the trial of the implements than is usually given; and probably if the list increases, as it has done for some years, it may be found necessary to divide the implements into three or four classes, and to offer prizes for one class only in the year. In this way much more time would be allowed for trials, as each class would only be tried once in three or four years.

The plan we intend to adopt in this report, as most interesting and useful, is to form the implements into groups, on each of which a few general remarks will be made, entering at the same time into such details on any of the sections as may be thought necessary. This will be found to be more generally interesting and practically useful than if we were merely to enumerate the different sections, state the number of entries, the successful competitors, and give a few dry details. It is fortunate that the carrying out of this plan will be very much simplified by the principle adopted by the Directors in making out the premium list of implements. There is a regular order observed in the list, though not observable to most people. Premiums are offered first to those implements required for preparing the soil for the seed—then for those used for depositing the seed—next for those for top-dressing the crop—for those for clearing it—for those for reaping it—for those for thrashing it, &c, &c. Such a systematic arrangement is decidedly the best that can be adopted in the Show-yard, and recommends itself at once to the approval of the members, as it facilitates the examination of the implements both by the Judges and the public. We have heard some exhibitors objecting to the arrangement, from its entailing upon them consider-

ably more expense in looking after their implements scattered over the yard in different classes, than if they were collected together into one place at their stand or general collection. This is no doubt true; but, in making the detailed arrangements of the Show, we ought never to lose sight of the great objects of such exhibitions—viz. the improvements of our machines and implements, by collecting them together for comparison and for competition. And no comparison can ever be satisfactorily made if an individual is to wander from one exhibitor's stand to that of another, to examine implements of the same class. While everything should be done for the convenience of the exhibitors, the object of the exhibition and the convenience of the visitors must not be overlooked; and we must not forget the character of the *exhibition*, by converting it into what would be little else than a *fair*, if the articles were arranged as these objectors propose. Through time we might perhaps have the exhibitors of different descriptions of stock demanding that their stock should be all placed together, so that they may be more easily taken care of by fewer servants. The request would not be more unreasonable than that made by some of the implement exhibitors at present. Ultimately the sectional or class arrangement may be found to be best for the exhibitors also; for visitors, after a proper examination of the implements in one class, and deciding upon the best, naturally make inquiry after the exhibitor of it, with the view of purchasing it. If they had not had an opportunity of examining and comparing the implements arranged in classes, but had been compelled to put off their time wandering from stand to stand, probably they would not have purchased it at the time. The sectional and stand arrangement may in some measure be combined by exhibitors attaching large placards to the implements exhibited in the classes, informing the public at what part of the Show-yard they are to be found.

According to the plan proposed, then, the implements and machines will be divided into the following groups:—Group A, implements required for preparing the soil for the seed, comprehending all from section 1 to section 16 inclusive; Group B, sowing-machines, from section 17 to section 26; Group C, machines for preparing and distributing manures, from section 27 to section 30; Group D, machines for cleaning the growing crops, singling turnips, and raising potatoes, from section 31 to section 34; Group E, harvest machines, from section 35 to section 39; Group F, machines for thrashing and preparing grain for market, from section 40 to section 45; Group G, machines for preparing and holding food for animals, from section 46 to section 59; Group H, dairy implements, from section 60 to section 64; Group I, carts and other carriages used on the farm, from section 65 to section 68; Group L, horse and stable furniture, sections 69 and 70; Group M, stack pillars and frame, section 71; Group N, fences and gates, from section 72 to section

77; Group O, tile and pipe machines, and tiles and pipes and tools used in drainage operations, from section 78 to section 83; Group P, miscellaneous apparatus, machines, and implements.

Group A.

In this group are included the different descriptions of ploughs, harrows, rollers, clod-crushers, swing-trees, &c. Great and numerous are the changes which have taken place of late years in the opinions of practical agriculturists on points connected with their business, and consequently in the management and operations of the farm. Amongst these changes we must reckon the variation in the methods of preparing the soil for the seed. There are those still living who remember the plough in its rudest form and harrows of as imperfect and rude construction, being the only implements thought necessary for the working of the land on farms situated in districts on which all the implements enumerated above are now in daily use. The introduction of summer fallow succeeded at a considerable distance of time, by the cultivation of the turnip, demanded improved implements, and a greater variety of them, than had previously been in use. But for many years the growth of the turnip being limited only to the naturally dry light soils, the improvements in this class of implements were not as rapid and general as they have been since the introduction of furrow-drainage and special manures. These have enabled the farmer to grow turnips on the heavy lands, which were before considered quite unsuitable for them, and have compelled him to call in the aid of the mechanic to construct machines and manufacture implements to assist him in the often laborious task of pulverising the clays for the growth of his turnips. A valuable addition, made many years ago to this class of implements, was Finlayson's harrow, which has undergone many changes and improvements, till we find it now in the more perfect form of the grubber. To the extended cultivation of the turnip, and other green crops, are we indebted for the present forms of grubbers, which have now superseded the ploughs in a great degree, in the working of the land in spring and autumn for green crops. Formerly the soil was not considered in a proper state for the sowing of the turnip seed till it had received at least two, and generally more, ploughings in spring; now, on most farms, the plough is never used at that season but for drilling. In autumn, too, where soil and climate are favourable, grubbers and scarifiers have taken the place of the stubble furrow. Ploughs, harrows, and grubbers, however, were found not sufficient for the proper reduction of clay soils, and hence heavy rollers, clod-crushers, and Norwegian harrows, have been added with great advantage to this class of implements.

Two-Horse Ploughs.—These have been subjected to as numerous, minute, but still important, changes as any class of agricultural im-

plements. To the names of Small, Wilkie, and Cunningham, have been added those of many improvers and manufacturers of ploughs; and if we are to judge from the premium lists, English makers are taking the foremost rank even in Scotland. For again does the name of Howard appear first in the awards for their New Patent Iron Wheel-Plough. This plough differs from the one for which the Howards obtained the first prize at Berwick, in the cut of the furrow, and in the mould-board being much more convex than that of the Berwick one. Indeed, if there is one feature in the exhibition of implements more worthy of notice than another, it is the greater convexity of the mould-boards which the English manufacturers have attached to their ploughs. And in none is this more observable than in the plough of Hornsby, which was entered not for competition, but for exhibition only. In short, in the principal English ploughs exhibited—namely, Howard's and Hornsby's,—there is a nearer approach to the Scotch ploughs in the setting of the irons and the form of the mould-board this year than has ever been observed before. To what are we to attribute this? The Duke of Athole, President of this Society, taking a great interest in the practical details of agriculture, and having purchased some English ploughs, resolved to have the merits of the English and Scotch ploughs compared and tested. He accordingly organised a ploughing match, open to all makers of ploughs, which was held at Stanley, in Perthshire, last spring. Some of the English makers, or their representatives, attended, who were convinced, by the work executed by the different ploughs, that the form of furrow, and the placing it in the position to form the seed-bed practised in Scotland, were the best for general purposes. The result of this day's work and observation at Stanley was the improved plough of Hornsby. It was shown at Warwick, and, contrary to the expectations of all the English makers, carried off the first prize for the best plough for light land, the first for the best plough for heavy land, and the second for the best plough for general purposes, the Messrs Howards' plough having beaten it in this class. "The share and turn-furrow, or breast, of Hornsby's plough are attached to the slide, or sole-plate, which is in fact the foundation of the patent principle, instead of to the frame, as in the usual method of construction; by this means the beam, handles, and frame are solid pieces of wrought-iron work, obtaining the greatest possible lightness with immense strength and durability." Besides this, the side-plate is extended back as far as the mould-board, or nearly so, thus giving greater steadiness in the draught of the plough, without increasing the friction and hardening of the soil in the bottom of the furrow, which would have been the case had the sole-shoe been increased in length. Indeed, the lengthening of the side-plate admits of the sole-shoe being shortened without the risk of the steady working of the plough being injured, and thus it is "more

easily made to follow the undulations of the land, so that the ploughing may be everywhere of the same depth."

It was certainly somewhat puzzling for a person in quest of the best plough to walk through the Show-yard, examine and select one from the many varieties exhibited,—from the rather abrupt mould-board of the Yester plough, 37 inches in length, to the graceful yacht-like forms of Howard's and Hornsby's, from 45 to 50 inches in length. He would require to see them at work in the trial-field; but even here he would scarcely have received satisfaction; for, owing to the drought which prevailed last summer, the soil of the trial-field, naturally friable and gravelly, was very hard and difficult to turn over, and few of the ploughs went sweetly in it. It was evident that the wheel-ploughs had the advantage of the swing ones in the soil, as the wheels kept them at a uniform depth, and left a more even bottom in the furrow. In summer ploughing generally wheels will have the advantage. For this reason—and as the objection found to the use of wheels by those who have tried them in Scotland is on account of their being easily clogged when the surface of the land is damp, and who have for this reason discontinued them—would it not be advisable to divide the ploughs into two classes, "wheel" and "swing?" Howard's plough was *facile princeps* of those competing; but Hornsby, though not competing, received permission to exhibit the working of his plough, which elicited the admiration of both farmers and implement-makers. The comparative advantages of the fittings of the English and Scotch ploughs were much discussed at the Show, and particularly the English practice of using cast-metal socks. There can be no doubt as to the economy of this practice where the land is free of large boulders; and we envy those farmers whose lands, having this exemption, admit of their using these cast-metal socks; but we fear that the prevalence of landfast stones in Scotland generally precludes, at least for a time, the general adoption of cast-metal socks in this country.

The English ploughs proved themselves to be much easier drawn at the trial, as the following notes testify: the numbers correspond to those in the catalogue, and the imperial stones are the average draught of each plough as taken from the self-registering dynamometer sheets:—

SCOTCH.			ENGLISH.		
No. 3, ...	30	imperial stones.	No. 12, Howard's,	24	imperial stones.
„ 5, ...	30	„	„ 21, Page's,	28	„
„ 7, ...	36	„			
„ 8, ...	36	„			
„ 9, ...	32	„			
„ 10, ...	36	„			
„ 11, ...	35	„			
„ 13, ...	36	„			
Carry over	271			52	

SCOTCH.			ENGLISH.	
Brought over, . .	271 imperial stones.			52 imp. stones.
No. 16, ...	30 „			
„ 17, ...	32 „			
„ 19, ...	32 „			
„ 25, ...	24 „			
„ 27, ...	32 „			
„ 28, ...	34 „			
14	455		2	52
Average draught of Scotch ploughs,	32 st. 7 lb.		Average draught of English ploughs,	26 st.
	26 st.			
Difference in favour of English ploughs,	6 st. 7 lb.			

Sections 2, 3, 4.—*Trench, or Deep-furrows, and Subsoil Ploughs for two or more horses.*—We observed a good deal of cast-iron used in some of these ploughs, which we consider unsuitable for the purpose to which they are put in Scotland generally, the sudden collision with and resistance from landfast stones being frequent and severe. We thought that the mould-boards in some of the trench-ploughs were not large enough to turn over the furrows required of them. It is a pity that the Tweeddale plough has never been tried in competition with the other varieties of trench-ploughs.

Section 5.—*Double Mould-Board Ploughs,* for forming drills or bulking, with attachment for lifting potatoes, were well represented, but presented no novelty. We were rather surprised that so few of the implement-makers in the district of the Show, who are known to have good working ploughs, with improvements of their own, did not exhibit. We would remind them that the advantage of exhibiting, even though they were unsuccessful, is to extend their business from being a mere local to what we would designate a national one. The attachments for lifting potatoes were of two kinds—namely, Lawson's Brander potato-lifter, and the plough-graip for lifting potatoes, both of which have been before exhibited. The former is a "simple instrument of six malleable-iron bars joined together in the form of a brander or gridiron," which is attached to the right side of the plough instead of the mould-board. The plough-graip is attached to the sole of a double mould-board plough, and consists of four bars of iron, joined together so as to form an instrument like the hand, with the fingers extended and wide apart. The effect of the action of both of these instruments is to scatter or disengage the potatoes from the soil, that they may be more easily gathered by the people.

Section 7.—*Two-horse Grubbers, or Cultivators.*—There were no fewer than twenty-two entries in this section, and we were particularly struck with the decided preference which was given to the use of hind wheels. There was only one exhibited which wanted the hind wheels. This agrees very much with the experience of many who have used these grubbers, such as Tenant's, which are not furnished with these wheels, particularly in those districts where the soil is somewhat stiff. They were found to be so very unsteady in the

working that it was considered necessary to add the hind wheels. The first prize in this section was awarded to Coleman and Sons, for their Cultivator, Grubber, Scarifier or Broad-share, which was exhibited at the Society's Show for the first time by the inventor, after it had acquired a well-earned character in England, the test of which is that it has gained there about fifty prizes, and upwards of 5000 copies of it have been sold, and are regularly used. It differs from all the other grubbers exhibited in the more perfect adjustment of its parts, and in its leverage, and in the lever acting immediately in connection with the teeth, raising and depressing them independently of the body or framework of the implement, instead of the same action being conveyed to the teeth through the body, which is the case in the ordinary construction of grubbers in Scotland. The advantage of this plan is that the body is always kept at the same distance from the surface of the ground, whatever may be the depth the teeth are working at. The points of the teeth are cast-metal, and are fitted on or slipped off when necessary; when it is required to use it as a scarifier, a set of broad shares are fitted on instead of the points of the teeth. We find the same objection to these cast-metal points and shares as we did to the cast-metal shares of the ploughs when they are used in a great part of Scotland. We have our doubts, too, as to the mode of action of the lever on the teeth being the best where there are landfast stones; for we are of opinion that it will be very difficult to disengage the implement when any of the teeth has been obstructed by one of these stones, as in applying the lever to free the tooth from the stone, we but press it more firmly on the stone, and there will be no disengagement from it till the whole implement has been moved back.

Section 8.—Norwegian Harrows, or Pulverising Land Rollers.—It would certainly be much better if this section were divided into two, as the two classes of implements are essentially distinct in their action, and the difficulty of judging them is thus much increased. There was nothing deserving of special notice in this section.

Section 9.—Consolidating Land Rollers.—The casting of some of these was the most perfect we ever recollect of seeing in the same class at any former Show. Croskill's improved Clod-crusher obtained the second prize. We consider this one of the most useful implements of the farm where the soil has any tendency to clay. It may be used most efficiently in place of the harrows and the ordinary smooth roller, after grass seeds have been sown. We need not allude at any length to the merits of this most useful implement, which are acknowledged in all countries. Since its introduction in 1832, it has undergone many most important improvements, which have now made it almost perfect. Besides being used for crushing clods, it is the best kind of roller we have for compressing soft soil, particularly in spring, when wheat that has been sown on it in autumn is apt to be thrown out. We believe that nearly 4600 of the clod-

crusher have been sold since its introduction, which, at an average price of £15 each, would make a sum of nearly £70,000 for one implement manufactured by one firm. We observed that some of the rollers were divided into three parts, instead of two. This was done as an improvement, as it was thought, from the rollers being considerably longer than usual, the divisions, if there were only two, would be too long. We would decidedly prefer two divisions even in a long roller, for at the turnings the implement will turn mainly on the centre division if there are three, and the surface will be a good deal dragged.

In the other sections of this group, comprehending Land Pressers, Ribbing Machines, Harrows for heavy and light land, and for covering grass seeds and swing-trees, common and equalising, we have nothing of importance to note. The Chain-web Harrows exhibited were made expressly for covering-in grass seeds, and therefore it was not necessary to make them stronger and heavier; but a use to which they could be most advantageously put is to the covering-in of seed in ground broken up for the first time, in which case much greater weight and strength would be required. We believe that they would be found to be of much greater advantage if applied to this purpose than if used for covering-in grass seeds.

Group B.—Sowing-Machines,

from Section 17 to Section 26: viz. Sowing-Machines, for grain—broadcast and drill—for grass seeds, for turnips, for turnips with manure, for mangold, for carrots, for beans, and dibbling or drop sowing machine with manure. Simplicity of construction was the most prominent feature in this group. In the two machines which gained the premiums for broadcast machines, the seed-box is placed at the centre of the travelling wheels, "which gives the lightest possible draught that is attained, by different arrangements, however, in each." In the first-prize machine, the box is in one piece, the axle of the wheels being also the seed-wheels. The box and the wheels, consequently, may be said to form one piece, and it cannot be accommodated for passing through gateways or narrow passages. To remedy this, a carriage for conveying the machine from one place to another is constructed, on which it is lifted, and the shafts are removed from the machine and attached to the end of the carriage, so that it and the machine are taken through narrow places endwise. The second-premium one is divided into three parts, and on this account no carriage is required for its transport from place to place, as the end compartments are folded up on the middle one when it is going through narrow places. It is superior to any of the others exhibited, in the box being placed much nearer the ground—an advantage which will be fully appreciated when grass seeds are sown in windy weather. A very ingenious contrivance attached to the machine, exhibited by Robert Mitchell and Son, for turning the

machine round on the frame when it is to be taken through a narrow passage, appeared to answer the purpose well, and excited a good deal of interest among the spectators. All the broadcast sowing-machines were adapted for sowing grass seeds as well as grain.

In the drill sowing-machines there was great sameness in the construction: all the exhibitors but one being Scotch, the machines wanted that complexity which distinguishes the English from the Scotch machines in this section. There is little change or improvement in the construction of them, or of those that have been exhibited for some years back; nothing at least calling for special remarks here.

The sowing-machines for turnips, mangold, and beans, present no new feature, if we except those which are constructed to sow both turnips and mangolds either in a continuous run or at certain intervals on the drop principle. Of the turnip sowing-machines we may remark that we have seen several constructed on a better principle, and in constant use, than any exhibited. The two mangold sowing-machines which gained the prizes are simple, and appear to work well, and we have no doubt that they will tend to lessen one of the difficulties that have been found to the extensive cultivation of this root in Scotland.

Group C.

Machines for Pulverising Guano, and for Distributing it and Liquid Manure, from Section 27 to Section 30.—Since the introduction of the light manures, the want of such machines as those comprehended in this group has been much felt. We derive only a part of the benefit of a manure if it is not reduced to a minute state of division, and equally distributed over the land. We believe that much of the superiority of manure applied in the liquid state to when it is applied in the solid, arises from its being as minutely divided as possible by being in a state of solution, and from the ease and equableness with which it can be distributed. The labour and expense of reducing guano and other light manures to the proper state of fineness, has been long complained of by those who use a large quantity of them, and different methods have been resorted to to effect this purpose, which have proved both tedious and inefficient. We are indebted, then, to those implement makers who have attempted to supply the want so much felt, and more particularly to those who brought forward their machines for exhibition. All of them effected the object contemplated, but some much better than others; and we would mention, in particular, the machine which took the first prize, exhibited by James Thomson, Stow. "This cheap little machine (price only £2, 15s.) broke hard lumps of guano and stones to a finer powder than any of the others; the arrangement is simple and efficient for clearing should it choke up in working. It would enhance its value if a suitable riddling apparatus could be attached. We believe that orders were received for

upwards of one hundred of them." We regret that none of the machines entered for breaking bones were exhibited. A cheap, small, and efficient machine of this description will be found of much value to the farmer, as it would in some measure render him independent of the manure manufacturers, some of whom are not over scrupulous as to what is the quality of the article they put into his hands.

Section 28.—Machines for Distributing Guano.—The one which obtained the first prize here, made by R. and J. Reeves, "seems a useful machine, having a row of teeth set in a revolving rod, so as to act as an archimedean screw, stirring the manure in the box, and ejecting it from apertures in the bottom at the same time." Mrs Thomas Sherriff's machine, which gained the Bronze Medal, is also well worthy of having attention directed to it.

The liquid-manure pumps and distributors showed no novelties. The improved liquid-manure or water-cart, exhibited by the Trustees of W. Croskill, was well worthy of the first prize. It is made altogether of iron, and is comparatively light. There was a great variety of pumps exhibited, all possessing more or less merit.

Group D.

Implements and Machines for Cleaning Growing Crops, &c., Section 31 to Section 34: *Horse-Hoes for drilled Grain and Green Crops.*—Simplicity, efficiency, and substantial workmanship, were the characteristics of all the implements in these two sections. We regret that Garrett and Sons were not represented in these sections.

Machines for Singling Turnips, Section 33.—Before expressing any opinion on these, we should like to see them at work. Perhaps arrangements might be made next season for testing their efficiency.

Machines for Raising Potatoes.—These, when tried, did not give the satisfaction expected. Those who have already the simple plough-graip, described under Section 5, are furnished with an implement much more simple, a great deal cheaper, less liable to cause interruptions in the work by going out of order, and which is as efficient, if not more so, than the machines in this section. Being frequently exhibited and described before; and as there is little change on them from previous years, we think it unnecessary to enter more into detail at present.

Group E

comprehends *Scythes, Reaping-Machines, and Hand and Horse Rakes;* in short, *Harvest Machines.*—There is no department of farm labour in which the extensive emigration, both from this country and Ireland, of late years, has told so severely as that of harvesting the grain crops. Not only has wages been high, but considerable difficulty has sometimes been felt in getting labourers even at the high rates going. The extensive

use of light manures with the grain crops in the high districts, thus hastening them on to maturity, and approximating harvest there to that of the low districts, aggravated the evil by increasing the demand for labourers. Farmers, therefore, were put to the necessity of attempting remedies for the evil, and both scythes, so commonly used in harvest in England and the North of Scotland, and reaping-machines have been extensively used. Of the exhibition of scythes at the Show, we have nothing to say; but we will confine our remarks on this group to the reaping-machines and horse-rakes.

Reaping-machines formed a prominent feature in the Show-yard, both from the numbers exhibited, and the variety of construction. The originals—viz. Bell's, M'Cormick's, and Hussey's, were all represented; the first by machines exhibited by Bell himself, and the Trustees of Croskill; the second by Burgess and Key, exhibited by James Shaw; and the third by Dray's champion reaping-machine and other machines, amongst which we may class that of Gardner and Lindsay. Others exhibited, from the improvements made on them, could scarcely be referred to one original more than another, but were a kind of mongrel, such as that of Lord Kinnaird's. Of the number exhibited, 7 were self-deliverers, and 5 required the assistance of a man to rake the grain off the platform after it was cut. Of the former class the following were selected and sent out to the trial-field for the purpose of being tested; Bell's, Brigham and Bickerton's, Croskill's Trustees', Lord Kinnaird's, Burgess and Key's, and B. Samuelson's: of the latter there were sent out Burn's, James Drummond's, Dray's, Gardner and Lindsay's, and T. Perry and Son's. Of these Burn's, Brigham and Bickerton's, and James Drummond's, gave up the competition at the first, as they failed to cut the crop, but ran over it when the word was given to commence.

The crop on which the machines were tried was barley, very light, being short and thin on the ground, apparently sawn out with grass, but with a thick growth of creeping succulent weeds. The ground did not appear to have been rolled, as there were a good many loose stones on the surface, which were apt to injure the machines, and caused stoppages every now and then. The crop had a considerable inclination to the north, which rendered cutting in that direction to be performed with difficulty and unsuccessfully. Altogether the crop was most unfavourable for machine-reaping. It was on the farm of Liberton Mains, in the occupancy of Mr Watson. A vast concourse of spectators were present, and took a keen interest in the proceedings. It was evident from the first that the Judges had a most difficult and delicate duty to perform. They were required to decide upon the merits of two distinct classes of machines, the one —viz. the self-delivering, shown to great disadvantage, from the condition of the crop they were required to reap; the other having a decided advantage in that very condition which told so much against the first class. From the shortness of the straw and thinness of

the crop, those machines which delivered it in swathes, laid it down by no means as well as they were wont to do, but in a straggling form; while, from the very same circumstance, the men who delivered it off the platform of the other machines, had abundance of time to collect it, by means of a rake, into sheaves, and lay it down as neatly as any shearer could have done it without the least oppression to themselves. The result would have been very different if the straw had been longer, and the crop thicker, or if it had been wheat instead of barley, for we have frequently observed that in such cases the men charged with delivering the grain are overwrought. In an experiment of this kind, then, we can scarcely consider the laying off of the grain as an element of comparison, as it was the work of the machine in the one case, and of a man in the other; and the manner in which it was laid off in the latter, was entirely dependent on the strength and adroitness of the man. If, indeed, the laying off of the grain is to be taken into account, it must tell in favour of the self-delivering machine as it performs this operation in addition to what is executed by the other machine. It must not be forgot that one of the great uses of a reaping-machine is to enable the farmer to have the means of avoiding the risk of loss by the shedding of his grain, by cutting down his ripe crop with the machine when he could not command labourers, to lift, sheaf, and bind it; and in such an emergency the self-delivery machine alone can as yet be used. But those machines requiring the aid of a man to throw off the grain had, from this circumstance, and the lightness of the crop, another advantage over the self-acting ones. When the former cut in the direction in which the grain was lying, the horses were made to go slower, so as to give the man more time to gather with his rake the standing crop to the cutters, and then throw it off when cut.

Taking everything into account, we do not consider the trial at Liberton Mains a conclusive one, and though it is always advisable to gratify the curiosity of the visitors to the Show by showing the machines at work, if there is only one field of grain suitable for the purpose in the neighbourhood, the trial for the premium should not take place till there is a sufficiency of ripe grain of all kinds to afford a fair trial. Such a trial would be much more satisfactory than one so limited as that at Liberton Mains, and would tend to do away with that capriciousness in the decisions so frequent in all competitions of reaping-machines. We would submit, with all deference, that in future, premiums should be offered for the best machines in the two classes—viz. the self-delivering class, and that requiring the aid of a man to throw off the grain.

Considering the unsuitableness of the crop for reaping by machinery the work was well done. The stubble was as close cut in some instances as if the scythe had been used, and in all cases it was superior to that left by the sickle generally. As we said before, those machines laying off the grain did not do it as well as

usual. Of the others, the man in Gardner and Lindsay's laid it off most neatly in sheaves ready to be bound. Dray's, Hussey's, and Perry and Son's, and Wood's, also made capital work in the cutting, and the sheaves were laid off by the man. The self-acting rake attached to Samuelson's as a substitute for the man did its work well, and excited great interest among the spectators. It appears to resemble Atkin's automaton reaper from the descriptions given of it. The Judges awarded the first prize to Burgess and Key, who carried off the first prize in the class of reapers exhibited by foreigners in France in July last, and also the Great Gold Medal Prize of honour, for exhibiting the best implement competing in both the French and foreign sections. Its mode of delivery is peculiar: the corn, on being cut, falls on a series of rollers fitted with archimedean screws, by which it is delivered in a continuous and well-formed swathe at the side of the machine. It is much lighter in the draught than Bell's. A considerable improvement has been made in this machine this year by attaching the small travelling wheel to a hinged side, so that the machine can be turned much more easily, indeed almost on its own ground. Bell's reaper was not forward in time for the French Exhibition, but it obtained the first prize at Brussels, to which it was forwarded at once, when the discovery was made that it was too late for the French Exhibition. Many will be gratified at the award of a prize to Bell at Liberton Mains. At the Highland Society's Show, held in Edinburgh in 1827, the attention of the Judges was directed to a very promising model of a reaping-machine, the invention of Mr Bell, student of theology, at Auchterhouse. To this student and his brother, the farmer at Inchmichael, are we indebted for reaping by machinery. When others were dreaming of machine-reaping as a chimera, the Inchmichael farmer was cutting more or less of his crop every year with his machine. With it he has travelled to many a Show, and in many a well-contested field he has, with his coat off, piloted it through the crop, amidst a host of curious and admiring visitors. We are sure that all the members of this Society sincerely wish that he will reap the fruits of his ingenuity, industry, perseverance, and energy, and that he will not, like many inventors, have to complain of the ingratitude of a world which was benefited by his invention, but neglected the benefactor.

Rakes.—It must have been no easy matter for the Judges to have selected the best rake, whether for horse or for hand, where they were all so good. Among the horse-rakes in particular, none would have been a rejectable article in the harvest field. No implement has been more improved since the Society awarded an honorary medal at the Show in 1827 to Mr Ronaldson, Saughead, for the merit of introducing into this country the American horse-rake, of which he exhibited a specimen. Still going on towards perfection, the manufacturers have been devoting their attention of late to two parts of the construction—namely, the lever or handle for raising

the teeth off the ground when they are loaded with the straws and heads of grain, and in the independent action of the teeth. We may mention a third improvement which has been made now for some years—namely, the facility of attaching and removing the teeth when any of them are injured. There were several methods of doing this observable in the classes exhibited, but we preferred that of Smith and Ashby's, in which, instead of the whole tooth having to be removed, only the half most liable to be damaged or to require repair can be taken off if wanted. Several contrivances were resorted to for assisting the man to depress the lever and raise the teeth, which were all more or less successful. The improvement made by the Messrs Howard is worthy of notice. In most of the rakes exhibited a bar of iron runs along the length of the implement, on which the teeth fall and rest when there is any small depression, such as a furrow, in the surface of the field in which the rake is working. This, of course, prevents any grain lying in the depression from being touched or raked up by the teeth. The Messrs Howard have dispensed with this bar, so that each tooth is depressed to any reasonable depth quite independent of its fellows, and no part of the surface is passed over unraked.

Group D.

Machines for Thrashing and Preparing Grain for Market, Sections 40 to 45.—*Thrashing-Machines.*—Sixty years have now elapsed since the first thrashing-machine was erected by Mr Meikle at Kilbeggie, in Clackmannanshire, on account of Mr Stein. This machine, no doubt, thrashed the grain from the straw, but it threw the grain, straw, and chaff, into a confused heap. It was only by degrees that the other parts of the present thrashing-mill were added to the drum, or simple thrashing apparatus. Rakes, or shakers, and winnowing-machines, when added, enabled the machine to execute the different processes of thrashing, shaking, and dressing the grain for market. Few alterations have been made on the thrashing-machine since Meikle's death, who left as a legacy to his country a machine which his genius had invented, improved, and, in its main parts, well-nigh perfected. But though we thus accord to Meikle the sole merit of the invention of the thrashing-machines at present in use, we ought not to forget that there were other workers in the same field, such as Menzies, Stirling, Kinloch, Ilderton, and Osely, whose names will always be associated with the history of thrashing-machines.

By universal consent thrashing-machines are now divided into two classes, Scotch and English. The distinguishing members in these two classes are the Drum and the Shakers. In the Scotch machine the drum is a close cylinder, covered with sheet iron, with two sets of crosses or arms of hardwood, the extremities of which extend beyond the circumference of the cylinder about 3 or 4 inches;

these projecting extremities are called the beaters, and have an iron plate bolted to them; and it is by means of them that the grain is beaten out of the straw. The diameter and length of the drum has varied at different times. At one time it was extended to 5 or 6 feet in length, and was 3½ feet in diameter; of late years, however, this length has been reduced to 3½ feet, and the diameter to 3 feet, say for a 6-horse-power engine. The revolutions per minute vary from 300 to 400. The action of the beaters is upwards, to which the ears of the grain are subjected only for about a fourth part of the circumference of the drum, even though the feeding-rollers may hold it well back. To this limited action of the beaters upon the grain is to be attributed the imperfect thrashing so often complained of. The shakers of the Scotch mills are generally of a square form, with concave sides, which, uniting at the angles, shoot out into the rake heads. In the best constructed thrashing-machines there are generally two shakers.

"The drum, or, as we would call it, the *rubber* of the English machine, though armed with what may be called beaters, does not in fact thrash by beating, but by rubbing the grain against a wire grating, and in this lies its best qualities. The drum is a skeleton formed of two wings of cast iron, fixed upon an axle, and to these wings are fixed 6 or 8 beaters, or *rubbers*, lying parallel to the axle, forming a skeleton cylinder." Its diameter never exceeds 24 inches, often as low as 20 inches, and its length is about 4 feet It revolves within a concave, which embraces nearly three-fourths of its circumference, and is nowhere more distant from the beaters than 1¼ inch. The concave is nearly throughout an open trellis or grating, composed of plates of iron and wire; and, to complete all, this drum makes from 800 to 1000 revolutions in the minute. It will be observed, that while the beaters of the Scotch drum act upon the ears of corn only for one-fourth of the circumference of the drum, with a velocity of 300 or 400 revolutions per minute, the beaters of the English drum act upon the ears for three-fourths of its circumference, rubbing them against the concave with a velocity of 800, or very often 1000, revolutions in the minute. The latter, then, cannot fail to thrash cleaner than the former, which also breaks the straw more from its being put into the drum end-wise instead of broad-side, as is done with the English mill. The shakers of the English machine are composed of 4 or 5 boxes, upwards of 8 feet in length, to which is communicated a vibratory motion by means of a crank, so that they move alternately down, forward, and backward, and carry the straw along till it is thrown off at the end of the machine. Most of the English machines are now furnished with what are called Goucher's Patent, which consists of diagonally-grooved plates of iron bolted on to the beaters of the drum. Hornsby still adheres to the button-like pieces of metal on his beaters.

There are now a good many different kinds of English thrashing-machines at work in Scotland. The first portable one was introduced by Mr Palmer of Lincoln, and was of Clayton and Shuttleworth's manufacture. Hornsby's, Robey's, and Foster's mills have also since been travelling in different districts. These differ more in the dressing apparatus, and in the mode of its arrangement, than in the essentials of a thrashing-machine. The same complaint is made of all of them that they break the pickles, a defect inseparable from the description of drum used. The husk of the oat, too, is very apt to be rubbed off from the same defect, which injures it very much for milling purposes; and brewers complain also of the barley thrashed by these mills not malting so well, evidently on account of its being too severely hummelled. We have heard complaints, too, of the skin of the wheat being ruffled to such a degree as to prevent its keeping in granary. So far as we are able to judge of them great improvements will require to be made on them before they will supersede the Scotch mills in Scotland, the latter being found, particularly after bad harvests, better adapted for the grain grown in a Scotch climate than the former. Nor do we think that the portable form will ever make great way in Scotland, on account of the uncertainties of the weather, and because the Scotch prefer fixed machinery, which is in every respect better and more economical. It has been found, moreover, that these portable machines require much greater power to work them than they are represented by their makers to require.

The trial at Myreside was conducted with great care and fairness by the Judges; nothing could exceed their anxiety to have justice done to all parties, and the machines fairly tried. The trial was with wheat and oats, and sheaf about was taken from the stacks, and the same number thrashed by each. The machines tried were Foster's, Robey and Co.'s, A. and W. Smith's, and James Haywood's. The exhibitor of the latter was never able to get it fairly into working order; and as it did not dress or clean the grain ready for the market, it did not compete with the other machines. Williamson Brothers exhibited a thrashing-machine for horses. It thrashed 87 sheaves in 12 minutes, producing 504 lb. of grain, and thrashing otherwise in a satisfactory manner. The following are the particulars of the trial:—

Myreside, 1st and 2d August 1859.

FIRST TRIAL.

	Cylinder.	Length of Stroke.	Dia. Fly Wheel.	Dia. Pulley.	Dia. Drum.	Strokes per Minute.	Revolutions per Minute.	Thrashed of Wheat in	Good Wheat.	Light.	Power of Engine.
		Inch.	Ft. In.	Inch.	Inch.			Min.		lbs.	Horse.
Foster's	$9\frac{1}{4}$	12	5 3	8	22	120	945	$8\frac{1}{4}$	$619\frac{3}{4}$	10	11
Robey's	$8\frac{3}{8}$	12	5 0	8	22	128	960	$8\frac{1}{8}$	600	14	$10\frac{3}{4}$
Smith's	9	14	5 0	8	21	128	960	9	568	$3\frac{1}{2}$	11

SECOND TRIAL.

Foster's thrashed 115 sheaves of wheat in $6\frac{1}{4}$ minutes, producing 26 st. 10 lb. grain.
Robey's „ 115 „ „ $5\frac{3}{4}$ „ „ 27 „ $3\frac{1}{4}$ „
Smith's „ 115 „ „ $7\frac{1}{4}$ „ „ 26 „ 0 „

THIRD TRIAL.

Foster's thrashed 70 sheaves of oats in $3\frac{1}{4}$ minutes, producing 19 st. $11\frac{1}{2}$ lb grain.
Robey's „ 70 „ „ 3 „ „ 19 „ 3 „

It will be observed that the two machines which the Judges considered as equally entitled to the first premium—viz. Foster's and Robey's—were found during the trial to require the power of 11 and $10\frac{3}{4}$ horses respectively, while the engines are entered in the catalogue as 8-horse-power and 7-horse-power. A suggestion has been made by one of the Judges, in which we heartily concur, that a year or two should elapse before any premium should be awarded to any thrashing-machine; but that the Society should announce in the next publication of its premium list, that a premium shall be given, say three years after this, for the best "Portable and Fixed Thrashing-machines."

Section 42 *and* 43.—*Fanners for Cleaning Grain and Grass-seeds.*—In both of these sections John Richardson, Carlisle, carried off the first prizes, with the machine to which was awarded the first prize at the Society's Show in Glasgow in 1857. There was upon the whole a good exhibition of these winnowing-machines, from the simple fanner so long in use, to the more complicated patent dressing apparatus of Mr Hislop, Prestonpans. Much ingenuity is displayed in the construction of this machine, which resembles in some measure the dressing apparatus or separator used in the English thrashing-machines. It consists of a long screen or sieve, covered with wire-cloth, of four different sizes of mesh; the first, adapted to pass mustard-seed, sand, mouse-droppings, and dust; the second, to pass worthless grains, grub-grass, papple, &c.; the third, to pass inferior pickles of grain in point of size, but some of which may be of good specific gravity; the fourth, to pass the large grain; at the

end of this division are two breadths of wire-cloth, the one to be opened when barley, and the other when oats are dressed. Stones, capes, rat droppings, sticks, and other large bodies, pass out at the end of the screw, and fall down a spout to which a bag may be attached. These different sizes of wire-cloth are tightened over an archimedean screw, so as to be easily removed, and at the same time to secure their revolving along with the screw. The two properties of size and specific gravity of the grain, are taken advantage of in the working of this machine, as in the ordinary fanners. What passes through the first two wire-cloths is not subjected to any blast, but at once falls into the bags as dirt or waste; some of the pickles, however, passing through the meshes of the third wire-cloth, may, though small, possess considerable specific gravity; these, when brought in contact with the blast, are separated from the lighter pickles, and fall into a trough in which is a screw which carries them forward to the space where the good grain is falling, while the lighter pickles drop into a receptacle for them. Some pickles, having size, and falling through the fourth wire-cloth, may be deficient in weight; these are blown into a trough in which is a screw, which carries it forward to where the small and lighter pickles fell. An ingenious contrivance of valves is adjusted at the outlet of the hopper through which the grain falls before being subjected to the blast. These valves are regulated by small weights pressing upon them; and their use is to spread the grain, as it issues from the hopper, into a stream of equal thinness, to be more efficiently acted on by the blast. There is no doubt that, theoretically, this machine possesses many advantages over the ordinary winnowing-machines, in the more extensive riddling surface,—in the more perfect apparatus for the separation of the grain,—and in the thinness of stream in which the grain is presented to the blast. But it must be admitted that these advantages are gained by a complication of machinery, which is always a great disadvantage in the implements and machines of the farm. Nor at the trial was the work performed by it at all satisfactory, the more simple fanners of Henderson, Grant, Porteous, and Williamson Brothers, producing a much better sample of grain, and more perfect separation of the good from the light, for all practical purposes. It is somewhat remarkable that, in these times of invention, the fanners which gained the second prize, and the working of which was considered not to be far behind that of the first, was just the old fanners of Carlaw, with some slight improvements, which have been long in use in different districts of the country, and have given great satisfaction. The material with which the fanners were tried was wheat just as it is thrashed, without being put through any fanners at all, and consequently containing some heads and chaff. In justice to Mr Hislop, we should state that the machine exhibited by him was adapted to power, and that it is not intended to act until the chaff has been removed from amongst

the grain; and also, the machine shown was got up in great haste in consequence of the non-arrival of the one intended for exhibition from the Warwick Show. We have only to express a hope then, that Mr Hislop will be better prepared to have his machine tried under more advantageous circumstances at another time.

On Sections 44 and 45, Weighing-machines, we have nothing to say, excepting to commend them for their accuracy in weighing and perfect workmanship.

Group G.

Machines for Preparing and Holding Food for Animals, from Section 46 to Section 59.—There is no group of equal extent and importance which calls for so little remark as this. Of late years we have had very trivial or no changes in the best of them, which appear to have reached a perfection beyond which their makers cannot carry them. And we are glad to see that those firms which have brought them to this state of perfection are still maintaining their pre-eminence, and have again been successful this year. We have, for instance, Richmond and Chandler carrying off the prizes for the best straw-cutter, linseed, oil-cake, and grain bruisers; the Trustees of W. Croskill, for the best root-washer; Picksly, Sims, and Co., for the best turnip-cutters for cattle and sheep; Smith Brothers and Co., for the best steaming-apparatus, &c. The implements in this group should possess unusual interest to the farmers of Scotland generally, and those in the district of the Show in particular, owing to the shortness of fodder and the failure of the turnip crop. That considerable economy of food is derived from the use of them, there is now no doubt. The mixing of different kinds of food, whether the produce of the farm or not, and the proper preparation of them for the different kinds of stock on the farm, must sooner or later become the practice or the rule on every farm, rather than as it is at present the exception. We would particularly refer to the pulping of turnips, and the mixing of them with chaff and cut straw. If ever there was a year in which farmers should be induced to try any method to economise their turnips, it is this; and we speak from experience when we say that the pulping of the turnips will enable them to do so. We observe that no premium has been awarded for the pulpers, the Judges not considering the only one exhibited—viz. Moody's Grater, worthy of a premium. We were sorry not to find one of Bentall's entered for competition, though some were in the yard for exhibition. It does its work most efficiently.

Group H.

Dairy Utensils, from Section 60 to Section 64, *comprising Churns for hand and power, Cheese-presses, and Curd-cutters, with general sets of Dairy Utensils.*—The interest which was excited about churns

some years ago seems, in a great measure, to have died away. The experiments then performed at the instance of the Society, appear to have satisfied people for a time, and till some other novelty shall have cast up, this group will attract only the passing attention even of those most interested in dairy management. The exhibition of the different sections and articles in the group was most creditable.

Group I.

Carts and other Carriages used on the Farm, from Section 65 to Section 68, were distinguished mainly for the finished and perfect workmanship of the implements exhibited by the Trustees of W. Croskill, which house has sold about 9000 carts, and upwards of 20,000 pairs of wheels, showing the repute in which they are held by the public. We think the Judges were right in not awarding a premium to any of the apparatus for conveying implements of the farm; for, however desirable such an apparatus is in farm management, encouragement should only be given to such as will really be suitable for the purpose, and not to what a farmer, having once bought and found inconvenient, is compelled to throw aside as lumber.

Group L.

Horse and Stable Furniture, Sections 69 and 70.—The Judges have acted cautiously here in awarding the premiums to the iron, rather than to the fire-clay furnishings of the stable. Nor can we blame them for this decision, for though the latter appear most serviceable and worthy of encouragement, we are not quite convinced of their being equal to iron, though cheaper. A little longer trial of them would give more confidence to the agricultural community at large, though we have a most favourable opinion from one who has had his stables fitted up with them for a year. They are certainly infinitely to be preferred to wood. The horse-harness was well worthy of commendation.

Group M.

Stack Pillars, Section 71.—The stathels of Young, Peddie, and Co., are now so favourably known that no remarks are necessary from us here, as the Judges have again signified their favourable opinion of them by awarding to them the first prize. We would rather direct attention to what may be considered a novelty in this section—viz. the substitution of fire-clay pillars for those of iron. There is now no doubt of the great advantage of these stathels where corn is to be kept for any time; and we believe that the high price of those made of iron, which are by far the best, is the only thing which prevents their being more extensively used. It is all well enough to speak of their permanency, and the advantage of a farmer making a permanent investment in them; but how can

they invest if they have not the capital? If, then, the pillars exhibited by John Robson, Glasgow, to which the second premium was awarded in this section, be as able to withstand the tear and wear as the iron ones, and be as effectual in keeping out vermin, the less cost of them must be a decided recommendation. The exhibitors, trusting to the impossibility of rats and mice creeping up the slippery enamelled surface of the pillars, have not, we think, made the top pillar proof against the vermin getting into the stack (as in the cup at the top of the iron pillar), in case of the enamel being rubbed off. Stone pillars, we think, will be found to be cheaper than either iron or fire-clay; and we are often surprised that those immediately interested in the sale of them, do not endeavour to make some improvement in them, so as to overcome that worst of all objections to them, that as they are too often made they do not answer the end contemplated.

Group N.

Fences and Gates, from Section 72 to Section 77.—In this group the principal prizes have been carried off by Edinburgh firms—viz. by J. M. Watson and Co. for gates, and Young, Peddie, and Co. for iron hurdles for cattle, and iron-netting for sheep. We were much pleased with the construction and workmanship of Watson and Co's. gates, and also with the articles of Young, Peddie, and Co. We do not think it possible that any manufacturers can offer at present for sale, with a fair profit to themselves, gates and hurdles of the same quality as these at a lower price. The prize dunghill-gate of James Denholm appeared to us to be rather light in its construction for the purpose intended, but the contrivance added by him for raising the gate was simple, easily worked, and displayed considerable ingenuity. We cannot say that we approve of the principle of opening dunghill-gates at different elevations. For, if there are cattle going on the dunghill, as in ordinary cattle-courts, when the dung gets a certain height, and the gate has been raised to correspond with that height, the weight of the cattle standing at the gate would press the dung through below the gate; or, if there were swine going on the dunghill, as is generally the case, they would soon, too, make a way for themselves through below the gate. It would perhaps be better to offer a premium for the "best dunghill-gate," without limiting it to those opening at different elevations. There are gates now constructed on a different principle we consider preferable to these.

Group O.

Tile and Pipe Machines &c., from Section 78 to Section 83.—This includes tiles and pipes; the machines for making them; glazed pipes for conveying water under pressure, and for sewerage; tools for cutting drains. We have nothing to remark on them, excepting to bear testimony to the superiority of all the articles exhibited.

GROUP P.

Miscellaneous and Extra Implements—Apparatus and Machines.—First among these we must mention the apparatus for manufacturing and supplying gas to country-houses and farm-steadings, exhibited by J. T. B. Porter and Co., Lincoln, to which was awarded the premium last year at Aberdeen, and which, after another year's trial, has been adjudged worthy of it at Edinburgh. It is a *multum in parvo,* containing retort purifiers, condensers, gasometer, and all the necessary pipes in very little space. Indeed, the only fault we ever heard found with it, is, that the parts are rather too confined. It possesses the great advantage of being easily managed by the most unskilled labourer; it extracts more gas from the same quantity of coal than the ordinary apparatus, and after the retort is heated to the proper temperature, it requires only the coke left over after the making of the gas, to keep up the heat during the time of making gas. If, then, we take into account all the advantages of lighting by gas over every other kind of artificial light, and we get an apparatus that can furnish us with that light at a much lower rate, at from 3s. to 4s. per 1000 cubic feet, and with much less trouble than any other apparatus, and in fact than any other light, it just becomes a matter of consideration with a proprietor or farmer, whether he can spare the original expense of erecting one which will vary from £100 to £200, including everything.

Next in order of the numbers, we would mention the ingenious hand turnip-drill for making up blanks; Bigg's sheep-dipping apparatus, so well known, and so often exhibited; Bradford's washing and wringing machines; and, particularly, Alexander Chaplin and Co's. patent portable double-cylinder steam-engine, with light verticle tubular boiler.

One of the most important collections in the yard was that of Francis Morton and Co., Liverpool, consisting of specimens of fire-resisting, self-supporting, galvanised iron roof, on galvanised iron pillars; of galvanised wire-cable, strand fence for horses, cattle, and sheep, with patent winding straining pillar; galvanised roofing tile; galvanised vermin-proof flooring plates, &c. The cost of the fire-proof roofs of corrugated iron is about that of the best slated roof, while that of the roofs of roofing tiles and plates will be cheaper. These tiles possess peculiar advantages for particular districts, over that of slates or roofing-tiles of clay, such as where the situation is high and exposed, and difficult of access. The iron roofs are less liable to be blown off, and the carriage of material is less. For implement-sheds, straw-houses, food-preparing houses, and, in fact, a great part of the roofs of the steading, the iron roofs of Francis Morton and Co. may be most advantageously used; but we would prefer slates with sarking to them in houses where cattle are kept; for in summer the iron would keep the houses uncomfortably warm, and in winter un-

pleasantly cold, while the breaths of the animals would be condensed on the cold iron, and fall in drops, even though the houses were perfectly ventilated. One of the greatest improvements on wire fencing of late years, is F. Morton's patent winding straining pillar. Wire fences could scarcely be said to be permanent without such an addition, for not long after erection they soon get out of order by the wires slackening, and other defects; and the use of them was on this account discontinued on many railways, and wood substituted for those which had been erected. The straining pillars will effectually remedy this defect. They are made of cast iron, and to them is attached a simple winding apparatus, with ratchet-wheel for keeping the wires to any degree of tightness or slackness that may be required; "being self-acting, they enable the straining to be done by ordinary farm labourers, in one-fourth of the time hitherto required, and admit of openings in the fence being made for carting, and closed again in a few minutes;" and being used as gate-posts, they save the repairs and the cost of separate gate-posts.

We would next mention the improved border dipping-tub of Raudin, No. 616, and the Dynamometer and Odometer of Alexander and George H. Slight, who had also a most admirable collection of implements of great variety. Mr George R. Stewart, 36 Renfield Street, Glasgow, also exhibited a model of M'Kinnel's patent ventilators. As the greater part of the diseases of the horses and cattle on the farm arises from bad ventilation, we would direct particular attention to this very simple and effectual means of withdrawing all the foul consumed air, giving a constant supply of fresh air, and keeping the temperature of the houses equable, and their interior pleasant. "It consists mainly of two tubes arranged concentrically, the inner discharging the vitiated air, while the fresh supply flows down the outer tube. It is almost automatic in its action, requiring little or no attention in ordinary circumstances." Its efficiency has been tested in churches, schools, reading-rooms, and railway carriages, and ample testimony has been borne by those who witnessed its working, and experienced the agreeable results, to the perfect success which had attended its introduction into all these different places. We have often seen Watson's patent ventilator at work, and have generally been pleased with the results obtained from it; but we consider that M'Kinnel's is superior to Watson's in two respects, first, in the better diffusion of the fresh air in entering the room, without the same risk of coming in contact and mixing with the vitiated air; and, second, in maintaining a more equable temperature, on account of the fresh air on its way to the room passing along the outside of the tube which conveys away the foul air, and thus becoming almost of the same temperature as it was before entering the room. Mr Stewart showed the model at work, in which the different currents of air were observed to traverse—the fresh down the outer tube, diffusing itself in the room, and the vitiated up the inner tube,

making its escape to the open air, by an orifice removed from that by which the fresh air entered.

General Collections.

This was a most useful part of the Exhibition, and added very much to its importance, interest, and display. Most of the principal agricultural implement manufacturers of England and Scotland had stands, in which were arranged a great variety of articles, upwards of 300 in number, most of which, from the bulky thrashing-machine to the tiny sausage-making machine, were exhibited at work. As was to be expected, this department was well patronised by the visitors. Most of the implements exhibited here had duplicates in the competition section, and do not therefore call for special notice again. Indeed, to do justice to this part of the Exhibition, we would transgress the limits of the space allotted for this report, and therefore we forbear making particular allusion to one collection more than another. On taking a general survey of them all, we could not fail to remark, that if iron has been substituted for wood in many of the implements and utensils of the farm, a bold attempt is now being made to bring into use fire-clay instead of iron. We have only to express a hope that these collections were as profitable to the exhibitors, as they were instructive, interesting, and useful to the visitors.

In concluding this imperfect Report of the Show, we must congratulate the members of the Society on the great success which attended it—a success unsurpassed, if ever equalled, at any former Show of the Society. This was mainly due to that unanimity and zeal which pervaded every class in the city and the country, in forwarding the patriotic objects of the Society. The members are laid under great obligations to the Directors and Secretary, for making those judicious preliminary arrangements, which tended much to facilitate future operations; to the Lord Provost, Magistrates, and Town-Council, for their hearty co-operation, and the facilities they afforded in carrying out the arrangements, and for their liberal donation to the funds; to the county gentlemen of the district of the Show, for the hearty manner in which they responded to the wishes of the Society, in voluntarily assessing themselves to assist in defraying the expenses of the Show; to the Committee of Supervision, for the zeal and diligence with which they discharged their most arduous duties; to the members of the Society of High Constables of the City, and other citizens, for the efficient aid which they rendered at various times during the Show; to Captain List, Captain Linton, and Lieutenant M'Lellan, for that admirable order which they maintained with their forces, throughout the whole proceedings in the show-yard, and in the trial-fields, without causing the least inconvenience to the thousands of visitors.

EDINBURGH SHOW, 1859.

PREMIUMS AWARDED.

CLASS I.—CATTLE.

SHORT-HORN.

Judges—ANTHONY CRUICKSHANK, Aberdeen; THOS. HUNT, Thornington, Northumberland; JOHN THOMPSON, Paston, Coldstream. *Attending Member* — RALPH P. NISBET of Elwick, Belford.

Section
1. Best Bull, calved before 1st January 1857—L.20 to George Shepherd, Shethin, Tarves. Second—L.10 to James Gulland, Newton of Wemyss, Kirkcaldy. Third—The bronze medal to William Tod, Elphinstone Tower, Tranent. The silver medal to S. E. Bolden, Springfield, Lancaster, as the *Breeder* of the best Bull.
2. Best Bull, calved after 1st January 1857—L.20 to John Hunter, Dipple, Fochabers. Second—L.10 to Thomas Rome, The Baurch, Annan. Third—The bronze medal to Alexander Bethune of Blebo, Cupar-Fife.
3. Best Bull, calved after 1st January 1858—L.10 to Lord Kinnaird, Rossie Priory, Inchture. Second—L.5 to C. Smith & Co., Hillhead, Ardersier. Third—The bronze medal to G. H. Binning Home of Argaty, Doune.
4. Best Cow of any age—L.15 to James Douglas, Athelstaneford, Drem. Second—L.8 to Wm. Tod, Elphinstone Tower, Tranent—(*under appeal*). Third—The bronze medal to James Douglas, Athelstaneford, Drem.
5. Best Heifer, calved after 1st January 1857—L.10 to James Douglas, Athelstaneford, Drem. Second—L.5 to James Douglas, Athelstaneford, Drem. Third—The bronze medal to the Duke of Montrose, Buchanan, Drymen.
6. Best Heifer, calved after 1st January 1858 L.8 to Messrs Turnbull, Bonhill Place, Dumbarton. Second—L.4 to the Duke of Montrose, Buchanan, Third—Bronze medal to Archibald C. Brodie, Abbey Mains, Haddington.

POLLED (ANGUS OR ABERDEEN).

Judges—ARTHUR GLENNIE, Ferniefiat, Bervie; DAVID M'CULLOCH, Auchness, Stranraer; GEORGE WILLIAMSON, Auldtown, Turriff. *Attending Member* —ANDREW FLETCHER of Salton.

7. Best Bull, calved before 1st January 1857—L.20 to the Earl of Southesk, Kinnaird Castle, Brechin. Second—L.10 to the Trustees of the late Robert Scott, Balwyllo, Brechin. Third—The bronze medal to Lord Talbot de Malahide, the Castle, Malahide, Dublin. The silver medal to William M'Combie, Tillyfour, Aberdeen, as the *Breeder* of the best Bull.
8. Best Bull, calved after 1st January 1857—L.20 to Robert Walker, Montbletton, Banff. Second -L.10 to Alexander Bowie, Mains of Kelly, Arbroath. Third—The bronze medal to James Leslie, Thorn, Blairgowrie.
9. Best Bull, calved after 1st January 1858—L.10 to the Trustees of the late Robert Scott, Balwyllo, Brechin. Second—L.5 to George Brown, Westerton, Fochabers. Third—The bronze medal to Sir James Graham of Netherby, Bart., Longtown.
10. Best Cow of any age—L.15 to John Collie, Ardgay, Forres. Second—L.8 to John Collie, Ardgay, Forres. Third—The bronze medal to William M'Combie, Tillyfour, Aberdeen.
11. Best Heifer, calved after 1st January 1857—L.10 to William M'Combie, Tillyfour, Aberdeen. Second—L.5 to George Brown, Westerton, Fochabers. Third—The bronze medal to the Trustees of the late Robert Scott, Balwyllo, Brechin.
12. Best Heifer, calved after 1st January 1858—L.8 to the Trustees of the late Robert Scott, Balwyllo. Second—L.4 to William M'Combie, Tillyfour, Aberdeen. Third—The bronze medal to John Collie, Ardgay, Forres.

POLLED (GALLOWAY).

Judges—ARTHUR GLENNIE, Ferniefiat, Bervie; DAVID M'CULLOCH, Auchness, Stranraer; WILLIAM SPROAT, Borness, Kirkcudbright. *Attending Member* —ANDREW FLETCHER of Salton.

13. Best Bull, calved before 1st January 1857—L.20 to W. & J. Shennan, Balig

Kirkcudbright. Second—L. 10 to Sir James Graham, of Netherby, Bart., Longtown. Third—The bronze medal to George Riddick, Greenhillhead, Lochmaben. The silver medal to W. & J. Shennan, Balig, Kirkcudbright, as the *Breeder* of the best Bull.

14. Best Bull, calved after 1st January 1857—L.20 to Samuel Thomson, Blaiket, Crocketford, Dumfries. Second—L.10 to Alexander Jardine, Jardine Hall, Lockerby. Third—*No Entry.*

15. Best Bull, calved after 1st January 1858—L.10 to John Cunningham, Whitecairn, Kirkpatrick-Durham. Second—L.5 to John Cunningham, Whitecairn, Kirkpatrick-Durham. Third—The bronze medal to James Graham, Meikle Culloch, Dalbeattie.

16. Best Cow of any age—L.15 to John Cruickshank, Cloves, Forres. Second—L.8 to John Cunningham, Whitecairn, Kirkpatrick-Durham. Third—The bronze medal to John Cunningham, Whitecairn, Kirkpatrick-Durham.

17. Best Heifer, calved after 1st January 1857—L.10 to W. & J. Shennan, Balig, Kirkcudbright. Second—L.5 to W. & J. Shennan, Balig, Kirkcudbright.

18. Best Heifer, calved after 1st January 1858—L.8 to Samuel Cunningham, Dunrod Mill, Kirkcudbright. Second—L.4 to W. & J. Shennan, Balig, Kirkcudbright. Third—The bronze medal to W. & J. Shennan, Balig.

AYRSHIRE.

Judges—John Baird of Lochwood, Coatbridge; Andrew M'Gregor, Ditton, Kilmarnock; John Waugh, St John's Kirk, Biggar. *Attending Member*—The Duke of Athole, K.T.

19. Best Bull, calved before 1st January 1857—L.20 to Sir James Colquhoun of Luss, Bart., Rossdhu, Dumbarton. Second—L.10 to John Parker, Nether Broomlands, Irvine. Third—The bronze medal to George Dow, Symshill, Cathcart. The silver medal to James Young, Broadholm, New Kilpartick, as the *Breeder* of the best Bull.

20. Best Bull, calved after 1st January 1857—L.10 to John Parker, Nether Broomlands, Irvine. Second—L.5 to Alexander Crichton, Middleton, Dreghorn. Third—Bronze medal to George Dow, Symshill, Cathcart.

21. Best Cow in Milk of any age—L.10 to Lawrence Drew, Merryton, Hamilton. Second—L.5 to John Marshall, Airbles Farm, Dalziel. Third—The bronze medal to George Pender, Dumbreck, Kilsyth.

22. Best Cow in Calf of any age—L.10 to Lawrence Drew, Merryton, Hamilton. Second—L.5 to Robert Kirkwood, High Langmuir, Kilmaurs. Third—The bronze medal to Alexander Murdoch, Hallside, Cambuslang.

23. Best Heifer calved after 1st January 1857—L.8 to George Pender, Dumbreck, Kilsyth. Second—L.4 to George Pender, Dumbreck, Kilsyth. Third—The bronze medal to H. D. B. Hyslop, Tower, Kirkconnell.

24. Best Heifer, calved after 1st January 1858—L.6 to John Parker, Nether Broomlands, Irvine. Second—L.3 to George Pender, Dumbreck, Kilsyth. Third—The bronze medal to James Robertson, Hall, Beith.

HIGHLAND.

Judges—Robert Anderson, Kildrummie, Nairn; John Macfarlan, Faslane, Helensburgh; William Webster, Daill, Islay. *Attending Member*—Alexander Henderson, Longniddry, Tranent.

25. Best Bull, calved before 1st January 1857—L.20 to Allan Pollok of Broom, Mearns. Second—L.10 to the Marquis of Breadalbane, Taymouth. Third—The bronze medal to George and John G. Smith, Minmore, Glenlivet. The silver medal to Allan Pollok, as the *Breeder* of the best Bull.

26. Best Bull, calved after 1st January 1857—L.10 to R. D. Campbell of Jura. Second—L.5 to Allan Pollok of Broom, Mearns. Third—The bronze medal to R. D. Campbell of Jura.

27. Best Cow of any age—L.10 to Allan Pollok of Broom, Mearns. Second—L.5 to James, John, and Joseph M'Laren, Muirpersie, Kirriemuir. Third—The bronze medal to the Marquis of Breadalbane, Taymouth.

28. Best Heifer, calved after 1st January 1856—L.8 to R. D. Campbell of Jura. Second—L.4 to the Marquis of Breadalbane. Third—The bronze medal to Allan Pollok of Broom.

29. Best Heifer, calved after 1st January 1857—L.6 to the Marquis of Breadalbane. Second—L.3 to the Marquis of Breadalbane. Third—The bronze medal to the Marquis of Breadalbane.

MEDALS FOR EXTRA STOCK.

Judges—Robert Hardie, Harrietfield, Kelso; George Milne, Haddo, Methlic; Thomas Stobie, Balneathill, Kinross. *Attending Member*—Captain Riddell, yr. of Ardnamurchan.

30. Best Cross-bred Cow of any age—The medium gold medal to David Ainslie of Costerton, Blackshiels. Second—The silver medal to Robert Hunter, Dalhousie Chesters, Lasswade. Third—The bronze medal to Robert Hunter, Dalhousie Chesters, Lasswade.
31. Best Cross-bred Heifer, calved after 1st January 1857—The medium gold medal to John Hunter, Dipple, Fochabers. Second—The silver medal to James Stewart, New Market, Aberdeen. Third—The bronze medal to James Stewart, New Market, Aberdeen.
32. Best Cross-bred Heifer, calved after 1st January 1858—*No entry.*
33. Best Cross-bred Ox, calved after 1st January 1856—The medium gold medal to J. and W. Martin, New Market, Aberdeen. Second—The silver medal to John Balfour of Balbirnie, Markinch. Third—The bronze medal to James Stewart, New Market, Aberdeen.
34. Best Cross-bred Ox, calved after 1st January 1857—The medium gold medal to James Stewart, New Market, Aberdeen. Second—The silver medal to George Brown, Balgarvie, Cupar-Fife. Third—The bronze medal to Robert Husband, Gellet, Dunfermline.
35. Best Polled Ox, calved after 1st January 1856—The medium gold medal to William M'Combie, Tillyfour, Aberdeen. Second—The silver medal to William M'Combie, Tillyfour, Aberdeen. Third—*No entry.*
36. Best Polled Ox, calved after 1st January 1857—The medium gold medal to William M'Combie, Tillyfour, Aberdeen. Second—The silver medal to William M'Combie, Tillyfour, Aberdeen, Third—*No entry.*
37. Best Highland Ox, calved after 1st January 1855—The medium gold medal to James Stewart, New Market, Aberdeen. Second—The silver medal to J. and W. Martin, New Market, Aberdeen. Third—The bronze medal to Allan Pollok of Broom.
38. Best Highland Ox, calved after 1st January 1856—The medium gold medal to John Armstrong, Townhead, Dumfries. Second—The silver medal to James Stewart, New Market, Aberdeen. Third—The bronze medal to Allan Pollok of Broom.

EXTRA CATTLE.

The Judges highly commended—A Short-horn Cow, belonging to James Douglas, Athelstaneford, Drem; and commended a Cross-bred Cow, belonging to Robert Husband, Gellet, Dunfermline; and two Cross-bred Heifers, belonging to John Hay, Oldfield, Thurso.

CLASS II.—HORSES,

FOR AGRICULTURAL PURPOSES.

Judges—Stallions: Robert Cossar, Chesterhall, Dunbar; Thomas Penny, Bartlehill, Brigham, Kelso; James Wilkin, Tinwald Downs, Dumfries. *Attending Member*—Andrew Millar, Niddry Mains, Kirkliston.

Judges—Mares: John Dove, Eccles Newton, Kelso; Wm. Forrest of Treesbank, Hamilton; Alex. Galbraith, Croy Cunningham, Killearn. *Attending Member*—W. S. Walker of Bowland.

Section

1. Best Stallion, foaled before 1st January 1856—L.30 to Christopher Graham, Inch Farm, Longtown. Second—L.15 to Alexander Sim, Fawells, Keith Hall. Third—The bronze medal to James Lawrie, Mitchelston, Stow. The silver medal to William Beattie, Easton, Cumberland, as the *Breeder* of the best stallion.
2. Best Entire Colt, foaled after 1st January 1856—L.20 to Peter Crawford, Dumgoyack, Strathblane. Second—L.10 to David Riddell, Kilbowie, Duntocher. Third—The bronze medal to Peter Wilson, Middlefield, Lesmahagow.
3. Best Entire Colt, foaled after 1st January 1857—L.15 to Andrew Logan, Crossflatt, Kilbarchan. Second—L.8 to Samuel Clark, Manswrae, Kilbarchan. Third—Bronze medal to Colonel Ferguson of Raith, M.P.

4. Best Entire Colt, foaled after 1st January 1858—L.10 to John Brown, Boghall, Biggar. Second—L.5 to Peter Crawford, Dumgoyack, Strathblane. Third—The bronze medal to John W. J. Paterson, Terrona, Langholm.
5. Best Mare (with foal at foot), foaled before 1st January 1856—L.20 to James Coubrough, Blairtummock, Campsie. Second—L.10 to Robert Morton, Dalmuir, West Kilpatrick. Third—The bronze medal to Thomas Smith, jun., Dalfibble, Dumfries.
6. Best Mare (in foal), foaled before 1st January 1856—L.15 to William Jamieson, Straiton, Liberton. Second—L.8 to William Stirling of Keir, M.P., Dunblane. Third—The bronze medal to Robert Walker, Portlethen Mains, Aberdeen.
7. Best Filly, foaled after 1st January 1856—L.10 to James Adam, Muirpark, Stirling. Second—L.5 to James Salmon, Benston, Johnstone. Third—The bronze medal to John Kerr, Morton, Mid-Calder.
8. Best Filly, foaled after 1st January 1857—L.8 to Mathew Gilmour, Town of Inchinnan, Paisley. Second—L.4 to Wm. Muir, Hardington Mains, Biggar. Third—The bronze medal to William Stirling of Keir, M.P.
9. Best Filly, foaled after 1st January 1858—L.6 to Wm. Aikenhead, Shaw Moss, Pollockshaws. Second—L.3 to Wm. Park, Balquhanan, Dalmuir, Dumbarton. Third—The bronze medal to John Kerr, Morton, Mid-Calder.

EXTRA HORSES.

The Judges commended—a Thorough-bred Stallion belonging to John M'Adam, Rose Street, Edinburgh; a Half-bred Colt belonging to Robert Dudgeon, Humbie, Winchburgh; a Cart-Horse in Harness belonging to Robert Brown, Park Place, Edinburgh, and a Shetland Pony belonging to Archibald K. Leitch, Inchstelly, Forres.

Class III.—SHEEP.

LEICESTER.

Judges—Thomas T. Cartwright, Well Vale, Alford, Lincolnshire; J. C. Langlands of Bewick, Alnwick; Thomas Scott, Broomhouse, Berwick-on-Tweed. *Attending Member*—Sir Hew Dalrymple, Bart.

Section

1. Best Tup, not more than four shear—L.10 to Thomas Cockburn, Sisterpath, Dunse. Second—L.5 to Thomas Cockburn, Sisterpath, Dunse. Third—The bronze medal to Samuel Wiley, Brandsby, York.
2. Best Dinmont or Shearling Tup—L.10 to Thomas Cockburn, Sisterpath, Dunse. Second—L.5 to Thomas Cockburn, Sisterpath, Dunse. Third—The Bronze medal to Samuel Wiley, Brandsby, York.
3. Best Pen of Five Ewes, not more than four shear—L.8 to John Collie, Ardgay, Forres. Second—L.4 to Thomas Watson, Esperston, Gorebridge. Third—The bronze medal to David Wallace, Balgrummo, Leven.
4. Best Pen of Five Shearling Ewes or Gimmers—L.8 to Samuel Wiley, Brandsby, York. Second—L.4 to Thomas Cockburn, Sisterpath, Dunse. Third—The bronze medal to the Duke of Richmond, Gordon Castle.

CHEVIOT.

Judges—William Aitchison of Linhope, Hawick; John Douglas, Norton Hall, Melrose; John Robson, Byrness, Otterburn, Northumberland. *Attending Member*—Richard Gordon of Hallmyre.

5. Best Tup, not more than four shear—L.10 to Thomas Elliot, Hindhope, Jedburgh. Second—L.5 to Thomas C. Borthwick, Hopsrig, Langholm. Third—The bronze medal to Thomas C. Borthwick, Hopsrig, Langholm.
6. Best Dinmont or Shearling Tup—L.10 to James Johnstone, Capplegill, Moffat. Second—L.5 to Robert Turnbull, Falnash, Hawick. Third—The bronze medal to James Johnstone, Capplegill, Moffat.
7. Best Pen of Five Ewes, not more than four shear—L.8 to James Brydon, Moodlaw, Langholm. Second—L.4 to Thomas Elliot, Hindhope, Jedburgh. Third—The bronze medal to Samuel Swan, Bush, Jedburgh.
8. Best Pen of Five Shearling Ewes or Gimmers—L.8 to Thomas Elliot, Hindhope, Jedburgh. Second—L.4 to Thomas C. Borthwick, Hopsrig, Langholm. Third—Bronze medal to James Brydon, Moodlaw, Langholm.

BLACKFACED.

Judges — GEORGE HOWISON, Rannagulzion, Blairgowrie; JOHN MACFARLAN, Faslane, Helensburgh; JOHN LORN STEWART of Coll, Campbeltown. *Attending Member*—JOHN FINNIE, Swanston, Edinburgh.

9. Best Tup, not more than four shear—L.10 to James Watson, Mitchellhill, Biggar. Second—L.5 to Thomas Murray, Eastside, Penicuik. Third—The bronze medal to Walter Murray, Walston, Penicuik.
10. Best Dinmont or Shearling Tup—L.10 to Adam White, Blindewing, Biggar. Second—L.5 to Thomas Murray, Eastside, Penicuik. Third—The bronze medal to James Watson, Mitchellhill, Biggar.
11. Best Pen of Five Ewes, not more than four shear—L.8 to Allan Pollok of Broom, Mearns. Second—L.4 to John M'Laren, Monzie, Blair-Athole. Third—The bronze medal to William Turner, Gavinburn, Old Kilpatrick.
12. Best Pen of Five Shearling Ewes or Gimmers—L.8 to Allan Pollok of Broom, Mearns. Second—L.4 to Thomas Murray, Eastside, Penicuik. Third—The bronze medal to John Wilson, Crosshouse, Roslin.

SOUTHDOWN.

Judges—GEORGE MILNE, Haddo, Methlic; PETER PURVES, The Grove, Brampton, Huntingdon; HUGH WATSON, Keillor, Coupar-Angus. *Attending Member*—JAMES MURRAY, East Barns, Dunbar.

13. Best Tup, not more than four shear—L.10 to the Duke of Richmond, Goodwood, Chichester. Second—L.5 to the Duke of Richmond, Gordon Castle, Fochabers. Third—The bronze medal to James Aitchison of Alderston, Haddington.
14. Best Dinmont or Shearling Tup—L.10 to the Duke of Richmond, Goodwood, Chichester. Second—L.5 to James Aitchison of Alderston, Haddington. Third—The bronze medal to the Duke of Richmond, Gordon Castle, Fochabers.
15. Best Pen of Five Ewes, not more than four shear—L.8 to John Hutchison, Monyruy, Peterhead. Second—L.4 to John Hutchison, Monyruy, Peterhead. Third—The bronze medal to Robert Scot Skirving, Camptoun, Drem.
16. Best Pen of Five Shearling Ewes or Gimmers—L.8 to the Duke of Richmond, Goodwood, Chichester. Second—L.4 to John Hutchison, Monyruy, Peterhead. Third—The bronze medal to the Duke of Richmond, Gordon Castle, Fochabers.

LONG-WOOLLED SHEEP OTHER THAN LEICESTER.

Judges—J. C. LANGLANDS of Bewick, Alnwick; THOMAS LAURIE, Terregles-town, Dumfries; THOMAS SCOTT, Broomhouse, Berwick-on-Tweed. *Attending Member*—JAMES WILSON, Sheriffside, Gifford.

17. Best Tup, not more than four shear—L.10 to Edward Handy, Sierford, Cheltenham. Second—L.5 to Edward Handy, Sierford, Cheltenham.
18. Best Dinmont or Shearling Tup—L.10 to Edward Handy, Sierford, Cheltenham. Second—L.5 to Edward Handy, Sierford, Cheltenham.
19. Best Pen of Five Ewes, not more than four shear—L.8 to the Duchess of Gordon, Huntly Lodge. Second—L.4 to Lord Kinnaird, Rossie Priory, Inchture. Third—The bronze medal to Robert Scot Skirving, Camptoun.
20. Best Pen of Five Shearling Ewes or Gimmers—L.8 to the Duchess of Gordon, Huntly Lodge. Second—L.4 to Lord Kinnaird, Rossie Priory, Inchture. Third—The bronze medal to Robert Scot Skirving, Camptoun, Drem.

CLASS IV.—SWINE.

Judges—PATRICK BRODIE, Clarilaw, Melrose; CHRISTOPHER COZENS, Hatherop, Fairford, Gloucestershire; ROBERT LYALL, jun., Carcary, Brechin. *Attending Member*—WILLIAM WILSON, Dechmont, Linlithgow.

Section

1. Best Boar, large breed—L.8 to John Harrison, jun., Heaton Norris, Stockport. Second—L.4 to William Jamieson, Straiton, Liberton. Third—The bronze medal to John Gordon of Aitkenhead, Cathcart.
2. Best Boar, small breed—L.8 to John Dickson, Saughton Mains, Edinburgh. Second—L.4 to George Mangles, Givendale, Ripon. Third—The bronze medal to John Harrison, jun., Heaton Norris, Stockport.

3. Best Sow, large breed—L.6 to George Robinson, Bolton Mills, Alnwick. Second—L.3 to John Harrison, jun., Heaton Norris, Stockport. Third—The bronze medal to John Mackay, Barrhead.
4. Best Sow, small breed—L.6 to George Mangles, Givendale, Ripon. Second—L.3 to George Mangles, Givendale, Ripon. Third—The bronze medal to John Mackay, Barrhead.
5. Best Pen of Three Boar Pigs, not exceeding eight months old—L.4 to George Mangles, Givendale, Ripon. Second—L.2 to Miss Bell, Woodhouselees, Canonbie. Third—The bronze medal to John Harrison, jun., Heaton Norris, Stockport.
6. Best Pen of Three Sow Pigs, not exceeding eight months old—L.4 to James Skinner, Woodside, Aberdeen. Second—L.2 to Jonathan Brown, Brewery House, Aspatria. Third—The bronze medal to Miss Bell, Woodhouselees, Canonbie.

CLASS V.—BUTTER.

Judges—FRANCIS RICHARDSON, Edinburgh; GEORGE MURRAY, Edinburgh. *Attending Member*—WM. DAWSON, Mannerston, Linlithgow.

1. Best sample of Powdered Butter—*No award.*
2. Best sample of Fresh Butter—L.5 to Robert Calder, Millar's Neuk, Kirkintilloch. Second—L.3 to Mrs Smith, Blairmuckhole, Whitburn. Third—The bronze medal to Andrew Macfarlane, Balmuldy, Bishopbriggs.

CLASS VI.—POULTRY.

Judges—GEORGE CUNNINGHAM, Middlefield, Dunse; THOMAS HUME, Thirlestane, Lauder; WILLIAM TROTTER, South Acomb, Newcastle-on-Tyne. *Attending Member*—Peter THOMSON, Hangingside, Linlithgow.

Section
1. Best Coloured Dorking Cock and Two Hens—The silver medal to John Gibson, Woolmet, Dalkeith. Second—The bronze medal to Lord Binning, Mellerstain, Kelso.
2. Best White Dorking Cock and Two Hens—*No entry.*
3. Best Coloured Cochin-China Cock and Two Hens—The silver medal to Mrs Sinclair of Benmore, Dunoon. Second—The bronze medal to Mrs Fergusson Blair of Balthayock, Inchmartine, Inchture.
4. Best White Cochin-China Cock and Two Hens—The silver medal to Mrs Fergusson Blair of Balthayock. Second—The bronze medal to D. Stratton, Mid-Calder.
5. Best Bramahpootra Cock and Two Hens—The silver medal to Mrs Fergusson Blair of Balthayock. Second—Bronze medal to Mrs Fergusson Blair.
6. Best Malay Cock and Two Hens—*No entry.*
7. Best Spanish Cock and Two Hens—The silver medal to Joseph Cockburn, Gogar Bank Cottage, Corstorphine. Second—The bronze medal to John Ridpath, Causewayside, Edinburgh.
8. Best Golden Hamburg Cock and Two Hens—The silver medal to Charles A. Lockhart, Westbridge, Kirkcaldy. Second—The bronze medal to Charles A. Lockhart, Westbridge, Kirkcaldy.
9. Best Silver Hamburg Cock and Two Hens—The silver medal to Francis Leonard, Murrayfield, Edinburgh. Second—The bronze medal to John Muirhead, Salton Middle Mains, Tranent.
10. Best Polish Cock and Two Hens—The silver medal to Alan Brooksby Cobbold, Broughton Park, Edinburgh. Second—The bronze medal to Mrs James Hunter, New Mains, Motherwell.
11. Best Game Cock and Two Hens—The silver medal to Matthew Buist, Tynninghame, Prestonkirk. Second—The bronze medal to Adam Curror, Myreside, Edinburgh.
12. Best Cock and Two Hens, any other breed—*No award.*
13. Best Bantam Cock and Two Hens—The silver medal to James Wilson, Wester Cowden, Dalkeith. Second—The bronze medal to Lord Binning, Mellerstain, Kelso.
14. Best Three Capons of any breed—*No entry.*
15. Best White Aylesbury Drake and Two Ducks—The silver medal to Lord Binning, Mellerstain, Kelso. Second—The bronze medal to Lord Binning.
16. Best Rouen Drake and Two Ducks—The silver medal to Mrs Fergusson

Blair, of Balthayock, Inchture. Second—The bronze medal to Miss Bell, Woodhouselees, Canonbie.

17. Best Drake and Two Ducks, any other breed—The silver medal to James Moffat, Ayton Castle, Ayton. Second—The bronze medal to Mrs Stewart, Bangholm Cottage, Edinburgh.
18. Best Black Norfolk Turkey Cock and Two Hens—The silver medal to John Muirhead, Salton Middle Mains, Tranent. Second—The bronze medal to Mrs Fergusson Blair, of Balthayock, Inchture.
19. Best Turkey Cock and Two Hens, any other breed—The silver medal to Mrs Fergusson Blair. Second—Bronze medal to Mrs Fergusson Blair.
20. Best Gander and Two Geese—The silver medal to Lord Binning, Mellerstain, Kelso. Second—The bronze medal to Lord Kinnaird.

EXTRA POULTRY.

The Judges commended a Cock and Two Hens, belonging to David Roughead, Haddington; and a Dorking Cockerel and Three Pullets, belonging to Miss Bell, Woodhouselees, Canonbie.

Class VII.—IMPLEMENTS AND MACHINES.

John Miller of Leithen, Millfield, Polmont, *Convener of Judges;* John Gibson, Woolmet, Dalkeith, *Superintendent of Trial Fields.*

JUDGES.

Sections 1 to 39—James Stirling, C.E., Edinburgh; John Lennie, Lauder Barns, Lauder; Robert Russell, Edinburgh. *Attending Member*—Alexander Henderson, yr. of Stemster.

Sections 40 to 45—George Bertram, Sciennes, Edinburgh; George Hope, Fenton Barns, Drem; James Melvin, Bonnington, Ratho. *Attending Member*—George Clerk Arbuthnot of Mavisbank.

Sections 46 to 87—Hugh Morton, Leith Walk, Edinburgh; John Cl·ror, Comiston, Edinburgh; Robert Patterson, Offers Farm, Stirling. *Attending Member*—Sir Thomas Buchan Hepburn, Bart.

Section

1. Best Two-horse Plough for general purposes—L.3 to J. and F. Howard, Bedford. Second—The bronze medal to George Sellar and Son, Huntly.
2. Best Trench or Deep-furrow Plough—L.3 to George Sellar and Son, Huntly. Second—The bronze medal to J. and F. Howard, Bedford.
3. Best Subsoil Plough for Two Horses—L.4 to James Kirkwood, Tranent. Second—The bronze medal to George Sellar and Son, Huntly.
4. Best Subsoil Plough for Three or Four horses—L.4 to Robert Law, Shettleston, Glasgow. Second—The bronze medal to James Kirkwood, Tranent.
5. Best Double Mould-board Plough for forming Drills, or bulking, with attachment for lifting Potatoes—L.3 to George Ponton, Woolston, Linlithgow. Second—The bronze medal to James Kirkwood, Tranent.
6. Best Ribbing Plough—L.2 to James Kirkwood, Tranent. Second—The bronze medal to Peter Macgregor and Sons, Keith.
7. Best Two-horse Grubber or Cultivator—L.4 to Coleman and Sons, Chelmsford. Second—The bronze medal to James Kirkwood, Tranent.
8. Best Norwegian Harrow or other Pulverising Land-roller—L.4 to David Young, Hassendean, Kelso. Second—The bronze medal to Alexander Jack and Son, Maybole.
9. Best Consolidating Land-roller—L.5 to Robert Wight, Seton, Prestonpans. Second—The bronze medal to the Trustees of William Crosskill, Beverley.
10. Best Land-presser for preparing Seed-bed for Grain—L.5 to Smith Brothers and Co., Kinning Street, Glasgow. Second—The bronze medal to Young, Peddie, and Co., Edinburgh and Glasgow.
11. Best Ribbing-Machine—L.2 to Mrs Thomas Sherriff, Westbarns, Dunbar. Second—The bronze medal to James Kirkwood, Tranent.
12. Best Harrows for Heavy Land—L.3 to J. and F. Howard, Bedford. Second—The bronze medal to James Kirkwood, Tranent.
13. Best Harrows for Light Land—L.3 to Edward Page and Co., Bedford. Second—The bronze medal to J. and F. Howard, Bedford.
14. Best Harrows for covering Grass Seeds—L.3 to J. and F. Howard, Bedford. Second—The bronze medal to Edward Page and Co., Bedford.

15. Best Common Swing-Trees or Draught-bars for Two Horses—L.1 to William Gray, Cambusnethan, Wishaw. Second—The bronze medal to George Ponton, Woolston, Linlithgow.
16. Best Equalising Swing-trees or Draught-bars for more than Two Horses—L.2 to William Gray, Cambusnethan. Second—The bronze medal to George Ponton, Woolston, Linlithgow.
17. Best Broadcast Sowing-machine for Grain—L.6 to George Finlayson, Gighty Burn, Arbroath. Second—The bronze medal to Alexander Dick, Smithy Green, Liberton.
18. Best Drill Sowing-machine for Grain—L.6 to William and James Hunter, Samuelston, Haddington. Second—The bronze medal to Mrs Sherriff, West Barns, Dunbar.
19. Best Sowing-machine for Grass Seeds—L.6 to George Finlayson, Gighty Burn, Arbroath. Second—The bronze medal to Andrew Tyrie, Errol.
20. Best Sowing-machine for Turnips—L.4 to George Finlayson, Gighty Burn, Arbroath. Second—Bronze medal to Alexander Jack and Son, Maybole.
21. Best Sowing-machine for Turnips with Manure—L 5 to R. and J. Reeves, Bratton Iron Works, Westbury. Second—The bronze medal to Nathaniel Smith, Thrapston.
22 Best Dibbling or Drop Sowing-machine with Manure—*No entry.*
23. Best Sowing-machine for Mangold—L.4 to J. and T. Young, Newton Green, Ayr. Second The bronze medal to Charles Hay, Freelands, Ratho.
24. Best Sowing-machine for Carrots—L 4 to Mrs Sherriff, West Barns, Dunbar.
25. Best Three-row Sowing-machine for Beans—L.4 to Mrs Sherriff, West Barns, Dunbar. Second—The bronze medal to George Hunter, Kippielaw, Dalkeith.
26. Best One-row Sowing-machine for Beans—L.1 to Alexander Jack & Son, Maybole. Second—The bronze medal to Andrew Tyrie, Errol.
27. Best Machine for Pulverising Guano, &c.—L.4 to James Thomson, Stow. Second—The bronze medal to James Mitchell, Fishers' Tryst.
28. Best Machine for Distributing Guano in drill or broadcast—L.6 to R. & J. Reeves, Westbury. Second—Bronze medal to Mrs Sherriff, Westbarns.
29. Best Liquid-Manure Distributing-Machine—L.4 to Trustees of W. Crosskill, Beverley. Second—The bronze medal to Isaac James, Cheltenham.
30. Best Liquid-Manure Pump—L.2 to Trustees of W. Croskill, Beverley. Second—The bronze medal to Smith Brothers & Co., Glasgow.
31. Best Horse-Hoe for Drilled Grain Crops—L.6 to W. & J. Hunter, Haddington. Second—The bronze medal to Smith & Ashby, Stamford.
32. Best Horse-Hoe for Green Crops—L.2 to William Gray, Cambusnethan. Second—The bronze medal to James Kirkwood, Tranent.
33. Best Machine for Singling Turnips—L.4 to P. M'Gregor & Sons, Keith. Second—The bronze medal to John Eaton, Kettering.
34. Best Machine for Raising Potatoes—L.4 to Smith Brothers & Co., Glasgow. Second—The bronze medal to Robert Law, Shettleston.
35. Best Scythe for general purposes—L.1 to James Smith, Lawhill, Auchterarder. Second—The bronze medal to James Payne, Kirkcudbright.
36. Best Reaping-Machine for one horse—L 10 to Gardner & Lindsay, Stirling.
37. Best Reaping-Machine for two horses—L.10 to James Shaw, Whiterigg, Ayton, Agent for Burgess and Key, London. Second—The bronze medal to George Bell, Inchmichael, Errol.
38. Best Horse-Stubble or Hay-Rake—L.2 to James Kirkwood, Tranent. Second—The bronze medal to Edward Page & Co., Bedford.
39. Best Hand-Stubble or Hay-Rake—L.2 to William Kirkwood, Duddingston, Portobello. Second—The bronze medal to Young, Peddie, & Co., Edinburgh and Glasgow.
40. Best Thrashing-Machine, adapted for two or more horses—L.10 to Williamson Brothers, Kendal.
41. Best Thrashing-Machine, with Steam-power—L 50 equally divided between William Foster, Lincoln, and R. Robey & Co., Lincoln.
42. Best Fanners or other Machine for Winnowing Grain—L.4 to John Richardson, Brunton Place, Carlisle. Second—The bronze medal to John Grant, Lenny Park, Corstorphine.
43. Best Fanners or other Machine for cleaning Grass-Seeds—L.4 to John

Richardson, Brunton Place, Carlisle. Second—The bronze medal to Robert Reid, Colliston Mill, Arbroath.
44. Best Weighing-Machine for Grain—L.4 to Herriot & Co., Græme Street, Glasgow. Second—The bronze medal to D. & J. Thomson, Edinburgh.
45. Best Weighing-Machine, indicating from 1 lb. to 2 tons—L.4 to A. & W. Smith & Co., Glasgow. Second—The bronze medal to D. & J. Thomson, Edinburgh.
46. Best Straw-Cutter for Hand-Labour—L.2 to Richmond & Chandler, Liverpool and Manchester. Second—The bronze medal to Picksley, Sims, & Co., Leigh.
47. Best Straw-Cutter for Power—L.3 to Richmond & Chandler, Liverpool and Manchester. Second—Bronze medal to Picksley, Sims, & Co., Leigh.
48. Best Turnip-Cutter for Cattle—L.2 to Picksley, Sims, & Co., Leigh. Second—The bronze medal to John Wingate, Alloa.
49. Best Turnip-Cutter for Sheep—L.2 to Picksley, Sims, & Co., Leigh.
50. Best Turnip-Cutter for Sheep, attachable to a Cart—L.3 to Mrs Sherriff, West Barns, Dunbar. Second—The bronze medal to James Kirkwood, Tranent.
51. Best Machine for Pulping Turnips—*No award.*
52. Best Root-Washer—L.2 to the Trustees of W. Crosskill, Beverley. Second—The bronze medal to George Porteous, Haddington.
53. Best Linseed-Bruiser for Hand-Labour—L.2 to Richmond & Chandler, Manchester.
54. Best Oil-Cake Bruiser for Hand-Labour—L.2 to Richmond & Chandler, Manchester. Second—The bronze medal to Smith & Ashby, Stamford.
55. Best Grain-Grinder or Bruiser for Power—L.6 to Richmond & Chandler, Manchester. Second—The bronze medal to Smith Brothers & Co., Glasgow.
56. Best Steaming Apparatus for Food—L.5 to Smith Brothers & Co., Glasgow. Second—The bronze medal to Richmond & Chandler, Manchester.
57. Best Feeding-Troughs for Byres—L.1 to Patrick B. Mure Macredie, of Perceton, Ayrshire. Second—The bronze medal to John Robson, Glasgow.
58. Best Feeding-Troughs for Sheep—L.1 to William Kirkwood, Duddingston. Second—The bronze medal to John Robson, Glasgow.
59. Best Sheep-Fodder Rack—L.2 to James Kirkwood, Tranent. Second—The bronze medal to Young, Peddie, & Co., Edinburgh.
60. Best Churn worked by Hand—L.2 to Robert Tinkler, Penrith. Second—The bronze medal to Philip Hunter, Edinburgh.
61. Best Churn worked by Power—L.3 to William Lindsay, Edinburgh.
62. Best Cheese-Press—L.2 to J. & T. Young, Newton-Green, Ayr. Second—The bronze medal to Smith Brothers & Co., Glasgow.
63. Best Curd-Cutter for Dairy Purposes—L.1 to J. & T. Young, Newton-Green, Ayr.
64. Best General Set of Dairy Utensils—L.1 to William Lindsay, Edinburgh. Second—The bronze medal to Philip Hunter, Edinburgh.
65. Best One-horse Cart, with Harvest Frame—L.4 to Robert Law, Shettleston, Glasgow. Second—The bronze medal to the Trustees of W. Crosskill, Beverley.
66. Best Harvest Cart—L.4 to the Trustees of W. Crosskill, Beverley. Second—The bronze medal to Robert Law, Shettleston, Glasgow.
67. Best Light Spring Cart—L.4 to the Trustees of W. Crosskill, Beverley. Second—The bronze medal to the Trustees of W. Crosskill, Beverley.
68. Best Apparatus for conveying Implements on the Farm—*No award.*
69. Best Divisions, Rack, and Manger for Farm Stables—L.1 to Adam Jack & Company, Glasgow. Second—The bronze medal to Young, Peddie, & Company, Edinburgh.
70. Best Farm Harness—L.1 to Hay Downie, Corstorphine. Second—The bronze medal to Thomas M. Berry, Leith.
71. Best Stone or Iron Stack Pillars, with Framework—L.2 to Young, Peddie, & Co., Edinburgh. Second—The bronze medal to John Robson, Glasgow.
72. Best Field Gate, constructed entirely of Iron—L.1 to J. M. Watson & Co., Edinburgh. Second—The bronze medal to J. M. Watson & Co., Edin.
73. Best Field Gate, not constructed entirely of Iron.—*No entry.*
74. Best Dunghill Gate, to open at different elevations—L.1 to James Denholm, Morningside, Edinburgh.

75. Best Iron Hurdles for Cattle Fence—L.1 to Young, Peddie, & Co., Edinburgh. Second—The bronze medal to Thomas Perry & Son, Glasgow.
76. Best Iron Netting for Sheep Fence—L.1 to Young, Peddie, & Co., Edinburgh. Second—The bronze medal to Bain, M'Nicol, & Young, Edinburgh.
77. Best Light Wooden Hurdles for Sheep.—*No entry.*
78. Best Pipe or Tile Machine for Hand or Power—L.6 to Edward Page & Co., Bedford.
79. Best Glazed Pipes for conveying Water under Pressure—L.5 to John Robson, Glasgow. Second—The bronze medal to John Grieve, Prestonpans.
80. Best Tiles and Pipes for Field-drainage—L.2 to John Robson, Glasgow. Second—The bronze medal to William Brodie, Dunbar.
81. Best Glazed Socketed Pipes for Sewerage—L.3 to Patrick B. Mure Macredie of Perceton, Kilmarnock. Second—The bronze medal to John Robson, Glasgow.
82. Best Tools for Cutting Field Drains—*No entry.*
83. Best Tools for cutting Open Drains in Hill Pastures—*No entry.*
84. Best General Set of Hand Implements for the Farm—L.2 to William Millar, Airntully, Stanley, Perthshire.
85. Best Apparatus for manufacturing and supplying Gas to Country-houses and Farm Steadings—L.10 to J. T. B. Porter & Co., Lincoln.
86. Best Wheelbarrow of Malleable Iron—L.1 to William Kirkwood, Duddingston, Portobello.
87. Best Barrow for conveying Cooked Food—L.1 to John Wingate, Alloa. Second—The bronze medal to John Wingate, Alloa.

EXTRA IMPLEMENTS, ETC.

The Judges commended—

Summer-house and Rustic Seats, belonging to J. T. Alexander, Carnoustie.

Hand Turnip Drill, and Sack Holder and Barrow, belonging to James Begbie, Haddington.

Patent Washing Machine, with Wringing and Mangling combined, belonging to Thomas Bradford, Manchester.

Patent Portable Double Cylinder Steam Engine, belonging to Alexander Chaplin & Co., Cranstonhill, Glasgow.

Patent Separator for drawing off the Whey from the Curd in making Cheese, belonging to Robert M'Adam, Silverdale, Newcastle-under-Lyne.

Machine for shaking the Grain from the Straw, belonging to Peter M'Lellan, Abernethy.

Machine for making Cattle-fencing, belonging to Alexander Macpherson, Carstairs, Lanark.

Revolving Machine for Dressing Flour, belonging to Alex. Mather, Edinburgh.

Collection of Galvanised Iron Roof-work and Wire-Fencing, belonging to Francis Morton & Co., Liverpool. (*Specially commended.*)

American Cast-Steel Hay and Straw Forks, belonging to James Payne, Kirkcudbright.

Straw-Rope Twister, belonging to Robert Robertson, Traprain, Prestonkirk.

Carrot Seed, Bearding and Clover and Trefoil Seed Milling and Dressing Machine, belonging to Thomas Scott, London.

Mowing and Rolling Machines, &c., belonging to A. Shanks & Son, Arbroath.

Dynamometer and Odometer, belonging to Alexander and George H. Slight, Edinburgh.

M'Kinnell's Patent Ventilators, belonging to George R. Stewart, Glasgow.

Patent Rotatory Force and Lift Pumps, belonging to John H. Winder, Sheffield.

Ten Drinking Fountains, belonging to George Smith & Co., 64 Port-Dundas Road, Glasgow. (*Specially commended.*)

Veterinary Medicine Chests, belonging to Gardner & Ainslie, 58 George Street, Edinburgh.

Mowing Machine, belonging to James Shaw, Whiterigg, Ayton, Agent for Burgess and Key, London.

THE FEEDING OF STOCK AS A BRANCH OF FARM MANAGEMENT.

By Thomas Anderson, M.D., Professor of Chemistry in the University of Glasgow, and Chemist to the Society.

[Address delivered at the *Edinburgh Show, 2d August* 1859.]

The feeding of stock, and its relation to the general management of the farm, is one of those matters equally important in a practical and a scientific point of view, in regard to which it is most essential that sound and definite information should exist. It has of late years attracted much attention; but though frequently discussed, it will be admitted on all hands that there is probably no branch of agricultural practice on which opinions are more divided. Doubts exist even on the most fundamental points; so that while one class of persons believe the feeding of stock to be a highly remunerative department of farming, others, with equal confidence, maintain that cattle are chiefly, if not entirely, valuable as machines for the manufacture of manure. And when details are inquired into, differences of opinion are found to exist as to the best kinds of food, the most advantageous means of employing them, and so many other matters, that there is really scarcely a single point in regard to which absolute unanimity can be said to exist. It was not without much diffidence that I ventured to select this subject for my address on the present occasion, the existence of these differences being a sufficient indication of the difficulties with which it is surrounded; for it scarcely needs to be observed, that had an easy solution of the points in dispute existed, or had a greatly preponderating mass of evidence been producible on one side or the other, controversy would long since have ceased. On the other hand, the existence of doubts and uncertainties renders the subject peculiarly suitable for discussion; for though we may not be able to arrive at incontrovertible conclusions, it is always advantageous to sift our knowledge, and to examine it in different points of view, so as to ascertain what may be relied on as correct, and what requires further proof or experimental elucidation. The result of such an examination shows that many commonly received statements rest on evidence which is far from conclusive, and the deficiency of proof is due in part to the want of a sufficient number of minute experimental inquiries, and in part also to the inherent difficulties and great complexity of the subject.

These difficulties are not unfrequently enhanced by individuals maintaining the exclusive excellence of the systems they themselves practise, and insisting that, because they have been led to adopt a particular opinion, their neighbour, who holds an opposite view, must necessarily be wrong. People are too apt to forget that, in the investigation of a subject in which the complex phenomena of life are involved, a great deal depends upon the particular

point of view in which the matter is considered; and a great point is gained when it comes to be admitted that two conflicting conclusions may both be right, and we set to work to trace out the cause of the discrepancy; for it then becomes necessary to look below the surface, and, by carefully weighing facts, to ascertain the principles on which they are to be explained. These principles, rightly elucidated and rightly applied, often show that the most apparently incompatible facts are the result of one natural law, which becomes at once a guide to direct us in the right path, and a beacon to point out that which ought to be avoided.

Every branch of human knowledge goes through some such phases. Intelligent and patient observers accumulate facts, and each founds his conclusions on the results of his own experience; but when these conclusions are compared and discussed, and they are found to be incompatible with one another, although the first impulse may be to maintain the inaccuracy of the observations by which one or other of them was substantiated, the more legitimate method is to examine them more minutely, and, if both are found, as will often be the case, to rest on equally good evidence, to seek for their reconciliation in a more extended knowledge of the conditions they involve, which thus becomes the starting-point for a new series of inquiries by which some general principle or principles are established.

Agriculture is now going through this phase of its history. Much acute and patient observation has established certain rules which must be observed if the cultivation of the soil is to be successfully pursued, and the good farmer knows how to apply them so as to suit the exigencies of his particular case. But almost all this knowledge has been in existence for a very long period, much longer, indeed, than is generally supposed. The great majority of the fundamental facts of agriculture were quite well known to the Romans, and they had adopted many things which are commonly considered to be quite modern improvements, such as the reaping-machine. It is curious to observe also that they encountered the same difficulties, but were unable to overcome some of those which have yielded to the efforts of modern agriculture, because the collateral sciences were then entirely uninvestigated, and the method of experimental inquiry which is now so important an auxiliary in in its progress was quite unknown. Matters are now in a very different condition, owing to the great progress which has been made in the study of the sciences bearing on practical agriculture, and with their assistance it has become possible to reconcile many discrepancies, to trace back to their causes the phenomena which have been observed, and thus to improve and economise our practical operations.

The feeding of stock is one of those subjects on which a knowledge of principles bids fair to throw light, and the recent progress

of physiology and chemistry have afforded many valuable data from which they may be deduced with some degree of certainty; and it is my intention on the present occasion to point out such of those as bear more immediately on agricultural practice, and to indicate their applications so far as our present knowledge will permit. It must not be forgotten, however, that our information is still very far from complete; and it will be readily understood that the perfect elucidation of a subject of such complexity, and touching on so many of the most abstruse and difficult problems of chemistry and physiology, and where it is necessary to eliminate the various disturbing effects dependent on the peculiarities of constitution of different animals by series of experiments of the most costly and elaborate kind, requiring the utmost care and frequent repetition, must be a slow process. Moreover, the best mode of feeding and managing stock, as a practical question, cannot well be isolated and discussed alone, but ought to be considered as an integral part of agricultural practice. It is necessary, for instance, to discuss not merely the fattening of the animal, but the quantity and quality of the manure produced. Other questions may also be raised, such as whether and under what circumstances it might not be advantageous to consume, as cattle-food, some of the crops commonly sold off the farm; and, in fact, the subject ramifies in many different directions. The complete discussion of these details would necessarily carry us far beyond the bounds of an address like the present, and I am therefore compelled to restrict myself, as far as possible, to general principles. In order to render these intelligible, it is necessary to commence with some fundamental positions.

It is to be observed, in the first place, that the food consumed by an animal, during its passage through the alimentary canal, undergoes a series of changes, as a consequence of which part of it is absorbed into the system, and part excreted. It is a matter of familiar experience that, if the food be properly proportioned to the requirements of an animal, its weight remains unchanged; and the inference to be drawn from this obviously is, that the food does not remain permanently in the system, but must be again got rid of. It escapes partly through the lungs and partly by the excretions, which do not consist merely, as is popularly believed, of the undigested part of the food, but also of that which has been absorbed, and, after having performed its allotted functions within the system, has become effete and useless. When the weights of the excretions, the carbon contained in the carbonic acid expired by the lungs, and the small quantity of matters contained in the perspiration, are added together, they are found in such a case to be exactly equal to the food. If the animal be deprived of food, it immediately begins to lose weight, because its functions must continue—carbon must still be converted into carbonic acid to maintain respiration—

and the excretions be got rid of, although diminished in quantity, because they no longer contain the undigested portion of the daily food, and the substances already stored up in the body are consumed to maintain the functions of life. Universal experience has taught us that, under such circumstances, the animal becomes lean, owing to its fat being used to support the process of respiration; but it is less generally recognised that the muscular flesh—that is, the lean part of the body—also diminishes, although it is sufficiently indicated by the fact that nitrogen, which chiefly exists in the flesh, still continues to be found in the urine, and that the animal becomes feeble and incapable of muscular exertion. Respiration and secretion, in fact, proceed quite irrespective of the food, which is only required to replace the loss occasioned by them. If we trace the course of events within the animal body, they are found to be somewhat as follows: The food is digested and absorbed into the blood, where it undergoes a series of complicated changes, as a consequence of which, part of it is converted into carbonic acid and eliminated by the lungs, and part is deposited in the tissues as flesh and fat. After the lapse of a certain period, longer or shorter, according to circumstances, a new set of actions come into play, by which the complex compounds of which the tissues are formed are resolved into simpler substances, and excreted chiefly by the lungs and kidneys. The changes occurring in this case are to a certain extent identical with those which would take place if the flesh and fat were burned in a fire; and the animal frame may, in a certain sense, be compared to a furnace, in which, by the daily consumption of a certain quantity of fuel, the temperature of the animal is maintained above that of the surrounding air. If the daily supply of fuel, that is of food, be properly adjusted to the loss by combustion, the weight of the animal remains constant; if it be reduced below this quantity, it diminishes; but if it be increased, one of two circumstances may occur: either the stomach refuses to digest and assimilate the excess, or it is absorbed and stored up in the body, increasing both the fat and flesh. The conditions under which this takes place are very important and remarkable. Supposing an animal, which by the use of a certain quantity of food is maintained at a constant weight, to have its daily supply increased, it immediately gains weight, and goes on gradually increasing until it reaches a point at which it remains stationary, however long the increased supply of food be continued. If the food be then decreased, the weight of the animal rapidly falls to its former level, the food which sufficed to maintain it constantly at the lower weight being no longer sufficient now that it is increased. And the reason for this is sufficiently obvious. At the lower weight the daily loss consequent on the performance of the vital functions, was exactly counterbalanced by the gain from the food; but when the weight increases, the newly-deposited matter undergoes a loss, which can only be replaced by an addi-

tional quantity of food. If after the animal has attained its constant weight the food be increased a second time, its weight again rises to a higher level; and so on with each addition to the supply of food. The inference from this is, that the quantity of food required to maintain an animal at a constant weight, depends essentially upon its absolute weight. Moreover, the effect produced by a given amount of food is not constant, but depends also to a very great extent on the condition of the animal. This may be best rendered intelligible by a particular example. Supposing a lean beast to be supplied with a pound of oil-cake in addition to the food to which it has been accustomed, it immediately begins to increase, and after some time will have gained—say, for illustration's sake, 20 lb., at which weight it remains. If its food be now increased by another pound of oil-cake, it will again increase, but to a smaller extent, perhaps not more than 15 or 16 lb.; a third addition will produce a still smaller gain; and so on, until a point is reached at which an increase of the food has no effect whatever on the weight of the animal The different effect of different quantities of food is here dependent on the fact that a lean animal is able thoroughly to exhaust the food given it, and to absorb a considerable proportion, of the nutritive matters contained in it; but when it becomes very fat, or its supply of food is very large in amount, its digestive organs are unable to assimilate all the nutriment supplied to them, and take only that part which is in the most readily digestible state. As an inference from this fact, it must be observed that, when an animal becomes nearly fully fattened, the last increase of weight is obtained by the expenditure of a large amount of food, and by an absolute waste of nutritive matters; and, practically, it becomes of the greatest moment to determine the point beyond which it is no longer economical to attempt to fatten an animal. It may be inferred also that a large lean beast may require a smaller quantity of food to keep it at a constant weight than a small fat one.

Practically, the problem which the feeder has to solve is, how to supply his cattle with such food, and in such quantities, as to insure the largest amount of increase with the smallest possible loss. And for this purpose it is necessary, not merely to select the largest quantity of nutritive matters, but to attend to the proportions in which they are mixed, and to restrain as far as possible all those functions which are productive of waste. For the solution of these questions, the nature of the food, the conditions on which its nutritive qualities depend, and its special suitability to particular purposes, must be considered.

All the different kinds of food consumed by herbivorous animals are found to present a general similarity in composition. They are composed of a nutritive and an indigestible part; the latter consisting chiefly of woody fibre, which appears to be quite incap-

able of assimilation. It is most abundant in the herbaceous parts of plants—as in the straw of the cereals and the stems of the grasses, and is almost entirely absent in the grains when deprived of their outer husk—as, for instance, in wheat flour. The nutritive part always consists of a mixture, in very variable proportions, of several substances, which may be separated by different chemical processes. If a quantity of wheat flour be tied up in a piece of rag and kneaded under a small stream of water, a fine white powder is observed to pass through the cloth and to collect at the bottom. This powder is starch; and when the cloth is opened, it contains a quantity of a sticky substance which may be drawn into strings, and is called gluten; in addition to these, a small quantity of oil may be detected, and also traces of indigestible matter. In wheat, starch is the most abundant constituent, and the oil forms so small a part as to be scarcely detected, except by careful experiment; but there are other kinds of food, such as linseed, in which these proportions are reversed. However much the relative quantities may vary, every food is found to contain at least three different substances, which are members of the three great classes into which the nutritive constituents of food may be divided, and which have received the names of the nitrogenous or albuminous, the saccharine or starchy, and the oily substances.

The nitrogenous substances embrace several compounds called gluten or vegetable fibrine, albumen, and caseine, besides some other varieties to which special names have been given. They are found most abundantly in the seeds of plants, as, for instance, in beans, peas, and linseed, in which they abound; oats, wheat, and barley containing less; while of the leaves, roots, and stems, they form only a small proportion. All these nitrogenous substances, however different in properties, are identical, or nearly so, in composition, and they are also identical with those substances of similar name which occur in the muscular tissues of animals. Thus there are a vegetable and animal fibrine, a vegetable and animal albumen, which can scarcely be distinguished from one another, either in properties or composition. And this fact is of importance, for it appears that animals obtain their nitrogenous nutriment ready formed, and in the same, or nearly the same, states of combination as those in which it is ultimately to be stored up within their system; and in this respect they differ exceedingly from plants, which are compelled to elaborate the simple compounds they absorb, and to convert them into complex substances fitted for the nutriment of animals.

What is true of the nitrogenous substances contained in plants and animals, applies also to their oily constituents. The plant elaborates from water and carbonic acid a variety of fatty bodies, from the solid butter-like palm-oil to the perfectly fluid product obtained from the olive or linseed; and these are completely identical with the fatty and oily substances obtained from different

parts of the animal body. They are all compounds of carbon, hydrogen, and oxygen—the former element preponderating, and forming about three-fourths of the whole. Though similar in composition, they are not absolutely identical, although the differences are not so large as to be of much importance, at least in relation to their nutritive properties.

Matters are very different, however, with the saccharine or starchy compounds, for they constitute a group altogether peculiar to plants, and are either entirely wanting in animals, or present in quite infinitesimal quantity, and, so far as we at present know, only in some of the secreting organs, and that under particular circumstances; at all events, they are never met with in sufficient quantity to be of any importance. All the members of this group are identical in composition—starch and sugar, which are the most important of them, being, moreover, convertible substances, many processes being known by which the one may be transformed into the other.

These classes of food constituents perform two different functions. The nitrogenous matters are employed to counterbalance the waste of the tissues, and to increase the quantity of lean flesh or muscle, and hence have been called the flesh-forming substances. The fatty and saccharine compounds, on the other hand, serve to maintain the process of respiration and the animal heat, and for this reason have received the name of the respiratory or heat-producing elements. They supply also the fatty matters stored up in the body, which, as we shall afterwards see, form a very large proportion of the weight to the animal.

It is sufficiently obvious that, as the two great functions of nutrition and respiration must proceed simultaneously, the best and most economical food will be, first, that which contains its constituents in the most readily assimilable form; and, secondly, that which contains them mixed together in the most suitable proportions.

In regard to the first of these points, it must be easily understood that, if two kinds of food contain the same quantities of useful nutritive matters, and in the same proportions, but in one they are conjoined with a large quantity of non-nutritive matters—as, for instance, of woody fibre—the latter will be considerably less valuable as a food, because its important constituents are thus enveloped in substances which protect them from the ready action of the absorbents, and consequently a part of their nutritive matters are never extracted, but pass through the animal entirely unused. Hence the value of a food is dependent in no small degree upon the quantity of woody fibre it contains.

The importance of a proper balance between the relative quantities of the two great classes of nutritive constituents must also be sufficiently obvious. If, for instance, an animal be supplied with food containing a large quantity of nitrogenous and a deficiency

of heat-producing compounds, the result must be, either that it languishes for want of the latter, or it is forced to supply the defect by an increased consumption of food; in doing which it must take into its system a much larger amount of nitrogenous matters than are requisite for supplying the waste of the tissues, and thus there is an unnecessary and wasteful expenditure of these substances. There is yet another possible case; for we might conceive that a part of the nitrogenous matters might be used for the support of respiration; but whether this ever occurs is unknown; at all events, it must clearly be anything but an economical mode of consuming food.

The proper adjustment of the relative proportions of nitrogenous and non-nitrogenous food, is the foundation of successful feeding, and its importance has of late years been fully recognised by chemists. Its adoption has, however, been to some extent delayed by the opinion expressed by Boussingault, that the value of a food was to be estimated by the quantity of nitrogenous matters it contained; a view which undoubtedly received countenance from the great nutritive effects obtained from oil-cake and other food containing a large quantity of nitrogenous matters. Later investigations, in which the particular causes of these effects have been examined, have shown that, however important these substances may be, their effect is brought out most completely when they are combined with the proper quantity of the respiratory elements. To determine the most suitable proportions in which these substances should be intermixed, is therefore a question of the greatest moment, and three modes of inquiring into it are open to us; *First*, We may examine the composition of the animal body, so as to ascertain the proportions in which they exist there; *Secondly*, We may inquire into the composition of the milk, which is the typical food supplied to the young animal; and, *Thirdly*, We may, by actual feeding-experiments, combined with analyses of the foods employed, seek to ascertain the proportions which yield the largest produce in the shape of flesh and fat, with the smallest expenditure.

The exact composition of the entire animal body is a subject of which but little has been known up to a comparatively recent time; but it has lately received a most important elucidation from a very elaborate series of experiments of Lawes and Gilbert, which have shown that the views commonly entertained on this point are completely at variance with fact. It has been usually believed and stated in most books, that the flesh—that is, the lean of animals—greatly exceeds the fat in quantity; but it actually appears that the very reverse of this is the case, and the error which has been committed is due to our having chosen to judge by the eye alone, without having recourse to precise experiments. Messrs Lawes and Gilbert selected ten different animals, as representatives of the different species of stock, in various states of fattening, which were

killed, and the different organs of the body being separately weighed and analysed, the total weight of the water, mineral matters, nitrogenous compounds, and fat, contained in the animal, was determined. The result was that, in the carcass—that is, the portion usually sold as human food—of a lean sheep, there were more than 1½ times as much fat as dry nitrogenous matters; in a half-fat sheep, more than twice as much; in a fat sheep, four times as much; and when exceedingly fat, the quantity may even be as much as six times that of the so-called flesh-forming elements. In a lean pig, the ratio of the fat and nitrogenous matters is as two to one; and, when moderately fat, as five to one. In a half-fat ox, there was one-fourth more fat than nitrogenous matters; and when moderately fat, 2⅓ times as much. As the general result of the observations, it may be concluded that, in the carcass of an ox in good condition, the quantity of fat will be from two to nearly three times as great as the nitrogenous matters; in a sheep, three to four times; and in a pig, four or five times as great. In the offal, including the hide, intestines, and other internal parts not usually consumed as food, the proportion is different, the quantity of fat being very much smaller, and that of nitrogenous matters proportionately large.

When the entire body of the animal is taken, it appears that the proportions of the different constituents are as follows:— The nitrogenous matters amount in the fat ox to 14½ per cent of its live weight; in the fat sheep, to 12¼; very fat sheep, not quite 11; and in the moderately fat pig, about the same quantity. In the lean animals there was about 2 or 3 per cent more. The quantity of fat was very much larger, and amounted, in the fat ox and lamb, to about 30 per cent; fat sheep, 35½; very fat do., 45¾; and moderately fat pig, 42¼ per cent.

As a general statement, we may assume that a fat animal will, on the average, contain 3 per cent of mineral matter, 12½ nitrogenous compounds, 33 of fat, and 48½ of water.

In lean animals, on the other hand, the proportion would appear to be somewhere about 5 per cent mineral matter, 15 nitrogenous matters, 24 of fat, and 56 water.

These data, accompanied by a knowledge of the relative weights of lean and fat animals, enable us to ascertain the composition of the increase during the fattening process. It is obvious, from the material diminution in the per-centage of water, that the matters deposited in the tissues must contain a much larger quantity of dry matter than the whole body; and the reduced proportion of nitrogenous matters shows that the fat must greatly preponderate. In fact, if we suppose an ox to increase in weight by 100 lb., it appears that there are added to it from 60 to 65 lb. of fat, 7 or 8 of nitrogenous matters, 1 to 1½ mineral matter, and 25 to 30 of water. In sheep there are 65 to 70 of fat, to 7 or 8 of nitrogenous matters; and in pigs, 65 to 70 per cent of fat, and 6 or 8 of nitrogenous matters.

As a general rule, therefore, the increase contains from eight to nearly ten times as much fat as it does nitrogenous matters.

The inference to be drawn from these facts is, that the food supplied to the fattening animal ought to contain a greatly preponderating quantity of non-nitrogenous constituents; a conclusion which is, at first sight, entirely at variance with the universally admitted advantage derived from the use of oil-cake and bean-meal, which are the most highly nitrogenised kinds of vegetable food. We shall afterwards see to what this apparent discrepancy is due.

The composition of the milk, the food supplied by nature for the maintenance of the young animal, must be admitted to afford special instruction as to its requirements during the early period of its existence; and although the conditions are very greatly altered when it has arrived at maturity, it indicates some points which, at all periods of life, must merit attention. The milk of different animals varies considerably in composition, but there is a remarkable uniformity in those ordinarily met with on the farm. That of the cow, the ewe, and the goat, may be stated in round numbers to contain 4½ per cent. of nitrogenous substances, 3 of butter (*i.e.*, fat), and 5 of sugar, the remainder being water, with a small proportion of mineral matters. It is to be noticed here, in the first place, that milk contains a member of each of the three great groups into which the food constituents are divided; and it may be inferred that such a mixture must be most readily digestible and assimilable by the tender organs of the young animal. It is well known that, to the mature animal at least, fat is not an absolutely essential constituent of its food, for it possesses and exercises the power of producing it from sugar and starch; but it may with confidence be assumed that its nutrition will proceed with greater ease and certainty if, imitating the composition of the milk, we afford it a supply of ready-formed fat. The ratio subsisting between the nitrogenous and non-nitrogenous substances in milk is nearly as 1 to 2, which is not very different from that found in a lean animal; and the inference which may be drawn from this fact is, that the milk is a food adapted to the requirements of early life, when there is no *accumulation* of fat, but when the development of all the parts of the animal is proceeding *pari passu;* but that, when the conditions alter, and the formation of muscle becomes less rapid, and that of fat starts into activity, a different ratio of these elements must be furnished in the food, although their mixture must still occur in such a manner as to imitate as nearly as possible what is found in the milk. Whenever the calf leaves the mother and takes to the pasture, it begins to consume a food totally different from milk, which, independently of indigestible woody fibre, contains its nitrogenous and saccharine constituents in entirely different proportions, and is especially deficient in fatty matters. In a state of nature, of course, this change takes place gradually, the calf continuing to derive a certain amount of sustenance from the mother

while it begins to consume grass; but on the farm, matters are different, and hence the advantage of giving weaning calves food containing a considerable quantity of linseed, so as to supply a larger proportion of both fatty and nitrogenous matters.

But though the matters just discussed necessarily lead to valuable conclusions, many of which must suggest themselves to every one who has attentively studied the subject, they must yield in importance to those deducible from carefully conducted feeding-experiments. The composition of the milk may teach what substances a food ought to contain, and that of the fattening animal enforce upon us the necessity for a very liberal supply of the respiratory principles, but they are very far from indicating with certainty the proportions in which these different classes of substances ought to be mixed in all cases.

A knowledge of the extreme complexity of the changes attending the digestion and absorption of the food is sufficient to guard us against drawing conclusions with too implicit confidence from these facts; and the necessity for caution becomes still more apparent when other circumstances are taken into consideration. It must be borne in mind that in all cases the proportion of the food consumed, which is stored up within the system, and goes to increase the weight of the animal, is comparatively small. Even in the case of milk, the food in which, of all others, economy in the supply of nutritive matters has been most carefully attended to by nature, a certain proportion escapes assimilation, and in the adult animal a very considerable amount of the food passes off with the excretions. The justice of this position is apparent, when it is remembered that an ox will go on day after day consuming from a hundredweight to a hundredweight and a half of turnips, three or four pounds of bean-meal or oil-cake, and several pounds of hay or straw, although its daily increase in live weight may not exceed a couple of pounds. And this consideration opens up a very fertile field of investigation, for it becomes necessary to inquire whether there are not certain substances from which the nutritive matters are more easily assimilated than from others, and what proportion of each is absorbable under ordinary circumstances. On this point we are still without information applicable to the individual feeding substances; but the experiments of Messrs Lawes and Gilbert have been so far extended as to determine the proportion of the total food, and of each of its constituents stored up in the system of the fattening animal. It appears that, for every hundred parts of dry matter contained in the food, from 8 to 9 are deposited in the tissues of the animal. But the proportions vary very much as regards the individual constituents. Thus, for every hundred parts of mineral matters consumed, only three are stored, and of nitrogenous compounds 5, and of fatty matters so much as 10 per cent. remain in the body. The knowledge of these facts tends to modify very greatly the conclusions which might be drawn from the composition of the in-

crease in the fattening animal. Thus, for instance, if the increase contained its nitrogenous and respiratory elements in the ratio of 1 to 10, it would be totally incorrect to supply these substances in the food in the same proportions; on the contrary, it would be necessary to double the quantity of nitrogenous matters, because while only one-twentieth of the amount supplied would be absorbed, one-tenth of the saccharine substances would be assimilated. This illustration may serve generally to show how the opinions we may form from a partial consideration of the subject, may be modified when it is looked at from another point of view, and the necessity for guarding against too absolute an expression of opinion on a subject still surrounded with difficulties.

Looking still further into the matter, it can scarcely be doubted that the proportion of the different nutritive elements stored up in the body is by no means constant, but depends on the nature of the food, and the particular state in which they exist in it. It is probable that some kinds of food contain their nitrogenous constituents in an easily assimilable state of combination, and their respiratory elements in an opposite condition, or *vice versâ;* and it is sufficiently obvious that in such cases the nutritive value of the substances must be below that which would be indicated by their composition alone. In many instances, in fact, the mechanical state of the food has a most important influence on its nutritive effect, as, for example, in the cases already indicated, where a large quantity of woody fibre is present, and protects the really assimilable portion of the food from the action of the gastric juices. In a similar manner, seeds, with hard husks, frequently pass unchanged through the animal, and this may and does happen with a certain proportion of all food. These points require to be taken into consideration in estimating the value of all feeding substances; and it is sufficiently obvious that they can be investigated only by careful experiments on animals.

And this leads us to return to the proper adjustment of the relative quantities of the great groups of nutritive elements, which has been already adverted to in a general way, and to discuss it somewhat more in full. It has been already remarked that a deficiency of any one element in its food compels the animal to consume an increased quantity, in order to obtain the amount of the deficient substance required for its nutrition; and in this way the other elements, which may be present in abundance, are practically wasted, and the theoretical and practical value of the food so constituted must be very different; and it is only when the relative proportions of the respiratory and flesh-forming substances are properly adjusted, that the most economical result, and also that most consistent with theory, can be obtained. And this consideration must be extended still further, for beyond doubt the *nature* of the particular nutritive compounds must be of moment,

especially in the case of the respiratory compounds, because the saccharine substances must be converted into fat by the vital processes, while the fatty matters contained in the food have only to be deposited as such in the tissues. It is probable that when the food contains only a small quantity of fat, the necessity for this action throws a heavier burden on the assimilating organs than they would have to bear if the food were rich in that substance. On this point, however, we are at present entirely in the dark, no experiments having as yet been made in which the effects of food rich in fat have been compared with those in which it is deficient, although the inferences which might be drawn from them would be very important. In the experiments of Messrs Lawes and Gilbert, the quantity of fat stored up within the animal was four times as great as that contained in the food, so that a very large proportion—three-fourths nearly—must have been generated from the starch and sugar of the substances they consumed. And this opens up a very important consideration, for it is manifest that a pound-weight of fat in the food, if assimilated, must produce a pound of fat in the animal; but as starch and sugar must undergo a chemical transformation, in the course of which they lose certain of their elements, and especially a very large proportion of the oxygen they contain, it comes to be a question how much of these substances is required to produce a pound of fat. It appears, from various considerations, which we shall not attempt to particularise, that about 2½ lb. of sugar or starch are required for this purpose, so that on this ground alone the nutritive value of fat must greatly exceed that of starch and sugar, and hence, no doubt, one of the important advantages of oil-cake and other highly oleaginous seeds. But there is another inference, especially worthy of notice, deducible from these facts; and it is, that if an animal has increased by a certain amount of dry weight, a much larger quantity of the food has been involved in the process, because the fat which, as we have already shown, always forms the chief part of that increase, is the representative of a very much larger amount of respiratory matters. In their natural state, all animals exercise very largely the function of converting starch into fat, but this is no reason why a more abundant supply of the latter might not facilitate the fattening process. At all events, in the case of human food, our natural instincts have led us to add fatty matters to many substances which contain a large proportion of other respiratory elements. Whether this be so or not, it is clear that the system of estimating the value of a food by adding together the different respiratory elements it contains, is no longer tenable. Thus, for instance, it would be incorrect to say that a linseed, containing 35 per cent of oil, and 20 of other respiratory elements, is inferior in this respect to wheat, containing 3 of oil and 65 of other respiratory substances. To arrive at a

satisfactory comparison, it is necessary to convert the oil in both cases into its equivalent in starch or sugar, and their relative values would then stand in the ratio of 107.5 to 70, showing a great preponderance in favour of linseed.

But there are other matters of not less importance in relation to the fattening of animals and the proper performance of their vital functions. It must be borne in mind that the food has not merely to increase the weight of the animal, but has also to maintain the process of respiration, the animal heat, and the constant waste of the tissues; and it is for this, among other reasons, that the animal consumes a very much larger amount of food than is found in its increased weight. The quantity consumed in the maintenance of these functions differs greatly according to circumstances; but it appears, from an experiment of Boussingault's, that in a cow the quantity of flesh-forming substances required to counterbalance the daily loss of these substances is about 18 ounces, which is contained in about 12 lb. of wheat flour and nearly 60 lb. of turnips. It is known, also, that from 4 to 5 lb. of carbon are daily converted into carbonic acid, to supply which about 100 lb. of turnips are required. Of course, these quantities vary very greatly in different animals and different breeds, and it is possible that they may be somewhat exaggerated; but there is no reason to suppose that they are very wide of the truth. We see from these facts that a very large quantity of food, relatively to that laid up in the body, is required for the maintenance of these functions, and are in a position to estimate the importance of attending to any circumstances which tend to the economy of this, which may be called the unproductive part of the food. Now, it has been ascertained by experiments, made chiefly on man, that muscular exertion is one of the most important causes of waste of the tissues, and of an increased respiratory activity. We cannot move a limb without producing a corresponding consumption of the matters already laid up in the body; and it has also been found that the difference in quantity of carbonic acid expired during rest and active exertion is exceedingly large. The inference from this is, that where it is sought to fatten an animal rapidly, every exertion must be made to restrain muscular motion, as far as compatible with health. Hence one of the main advantages of stall-feeding, in which the animal is confined to one spot; and the more thoroughly it can be kept still, the greater will be the economy of food. This is gained by darkening the houses, and excluding all persons, except when their presence is indispensable. All this, it need scarcely be observed, is practically quite familiar, and every one knows that a playful or irritable beast fattens much more slowly than one which is of a placid disposition; but it requires some knowledge of the facts just stated to impress on us with sufficient force the importance of minutiæ which appear

at first sight to be of comparatively little moment. The other great source of loss of food is the maintenance of the animal heat. It has been already observed that an animal may, in certain respects, be compared to a furnace, in which a quantity of fuel is burned to produce the animal heat. It is a familiar fact that at all times an animal is equally hot; and as the temperature of the air varies, it is manifest that in cold weather a larger quantity of fuel must be consumed to sustain this fixed temperature than in summer. Hence, if the animal be placed in a condition in which the difference in temperature between itself and the external air is as small as possible, there will be a proportionately diminished consumption of fuel. Stall-feeding operates advantageously in this way also, for the temperature in the houses, particularly during the principal feeding-times, being materially above that of the external air, a considerable economy of food is the result. It may, in fact, be stated as a general rule, that the warmer cattle can be kept the more rapidly will they fatten, all other circumstances being alike. At the same time, it must not be forgotten that the attempt to maintain a high temperature in the feeding-houses often leads to the dangerous error of diminishing ventilation to an injurious extent, under which circumstances another difficulty is encountered, for the animals, being reduced in health, refuse to consume a quantity of food sufficient for fattening. Indeed, the state of the animal's general health is a most essential element of success, and every precaution should be adopted to maintain it in the best condition. For this purpose the cleanliness and proper ventilation of the houses should be most carefully attended to, and the state of the dung observed, care being taken that the excretions are regular, and every tendency to scouring, or the reverse, immediately corrected. This can generally be secured by attention to the kinds of food supplied, as some of them affect the excretions in a very marked manner—bean-meal, for instance, having a tendency to produce constipation, and rape-cake being laxative. The judicious feeder bears these and similar facts in mind, and, avoiding an excessive supply of any kind of food possessing a special effect on the animal, aims at mixing different kinds in such a manner as to counteract the particular effects of each, taking care, however, to lean somewhat towards the laxative side, as it is found that cattle are most healthy and feed best when in that condition.

Although the presence of a sufficient quantity of nutritive matters in the food is naturally the most fundamental matter for consideration, its bulk is scarcely less important. The function of digestion requires that the food shall properly fill the stomach; and however large the supply of nutritive matters may be, their effect is imperfectly brought out if the food be too small in bulk, and it actually becomes more valuable if diluted with woody fibre, or some other inert substance. At first sight this may appear at variance

with the observations already made as to the effect of woody fibre in protecting the nutritive matters from absorption; but, practically, there are two opposite evils to be contended against—a food having too small a bulk, or one containing so large a proportion of inert matter as to acquire a disadvantageous bulk. The most favourable condition lies between the two extremes, and the natural food of all herbivorous animals is diluted with a certain proportion of woody fibre. When these are replaced by substances containing a large quantity of nutritive matters in a small bulk, the result is that the instinct of the animal causes it to continue feeding until its stomach is properly distended, and it consequently consumes a much larger quantity of food than it is able to digest, and a more or less considerable proportion passes unchanged through the animal, and is lost. On the other hand, if a food be too bulky, the sense of repletion causes the animal to cease eating long before it has obtained a sufficient supply of nutritive matter. It is most necessary, therefore, to study the bulk of the food, and to consider how to mix different substances in such a manner as to adjust the proportions of nutritive matter to their bulk. Practice affords abundant illustrations of how this may be effected, and the cause of the special advantages of particular mixtures can be thus explained. If we examine the nature of the mixed foods most in vogue among feeders, it will be most generally found that a very bulky food is combined with another of opposite properties. Hence turnips, the most bulky of all kinds of food, are used along with oil-cake or bean-meal; and if from any circumstances it becomes necessary to replace a large amount of turnips by the latter substance, the deficient bulk must be replaced by hay or straw.

Turning now to the actual results of feeding experiments, it is immediately apparent that the general conclusions which have been stated are fully borne out in practice. The question is then, however, so far limited, and reduces itself to determining how the crops commonly cultivated on the farm can be most advantageously used for feeding cattle, and whether they are best used alone or supplemented by foreign food, by which we mean substances not forming part of the usual farm-produce. These crops are hay, straw, turnips, mangold, potatoes, beans and peas, and the inferior qualities of the cereals; and they include those most remarkable for their bulky nature—the turnip, for instance, containing less than eight per cent of nutritive matters. All of them are also remarkably deficient in fatty matters—the bean, which is much richer than any of the others, rarely containing so much as five per cent. The result of all feeding experiments leads to the conclusion that animals cannot be brought to the highest degree of fatness upon turnips, or even on hay, alone. No doubt instances occasionally occur in which this can be accomplished; but it is only when these crops are cultivated in particularly suitable soils, and in very favourable sea-

sons, when they contain an unusually large quantity of nutritive matters; but these are altogether exceptional cases, and do not affect the general conclusion. A peculiarly interesting series of experiments by Wolff have shown that sheep, which, when fed on hay of average quality, attain a weight of about 90 lb., will gain an additional 10 lb. if rape-cake, or some other food containing a large quantity of nutriment, be given them. As a general rule, such substances as oil-cake, rape-cake, and bean-meal, &c, greatly promote the fattening process, and they operate partly by supplying a larger quantity of nutritive matters within the bulk which the stomach requires, and partly by increasing the supply of nitrogenous matters, in which they are particularly rich. This last conclusion may appear at variance with what has been already stated regarding the large proportion of non-nitrogenous substances stored in the fattening animal; but it must be understood that the good effects of those kinds of food are only observed when they are used in small quantity; and whenever a certain proportion is exceeded, the excess is entirely without influence. The advantage of these substances seems to depend on the fact, that in many kinds of food the proportion of nitrogenous matters is too small to permit the full benefit to be derived from the saccharine constituents of the food; and their effect is not confined to adding a certain quantity to the nutriment consumed, but serves to render available substances existing in the ordinary food, and which under other circumstances would be lost. An extremely remarkable example of this is recorded in the *Transactions of the Highland Society* for March 1852. Twelve beasts were fed with turnips and hay, and each consumed daily 216 lb. of the former, and 11 lb. of the latter; and on this diet the whole twelve gained, in the space of fourteen days, 409 lb. in live weight. Each now received 2 lb. of oil-cake daily; and although they did not immediately begin to gain weight, it turned out that, in the second period of fourteen days, their increase in live weight was 801 lb., being 392 more than before. If we estimate from the data before given as to the composition of the increase of fattening animals, this live weight must have corresponded to nearly 300 lb. of dry matter, which would be almost identical with the total solids in the 336 lb. of oil-cake consumed during the fourteen days. But during that very time the cattle actually consumed 1176 lb. of turnips and 168 lb. of hay less than they did before—quantities which must have contained some 250 lb. of dry matter; so that, in this case, an increase of about 50 lb. of dry matter in the food produced nearly 300 lb. in the animals. It need scarcely be observed that this is a very extraordinary case, and cannot often be expected to occur; but there is abundant evidence to show that oil-cake always produces a large effect, and that occasionally the gain in live weight is equal to that of the extra food consumed. All, however, depends upon the

ratio of flesh and heat-producing elements being the right one; and it would appear that this proportion differs according to the object of the feeding. Wolff, who has directed much attention to this subject, states, as the result of his experiments, that for maintaining animals at a moderate weight they should be as 1 to 8, for young cattle as 1 to 7, and for feeding as 1 to 5 or 6. He found by actual experiment that the production of milk was largest when the two classes were in the ratio of 1 to 7; but his conclusions with regard to fat cattle must be taken with some reservation. The most important point which he has brought out is the very high value of rape-cake; and it is interesting to know that in this respect his results bear out the repeated recommendations which chemists have given of that substance. He has shown that 1 lb. of rape-cake will produce 1 lb. of milk, and, under favourable circumstances, still more; and its effect was better than that of an equal weight of grain. It appears, also, that in feeding it is equivalent to more than twice its own weight of hay. The great difficulty which is encountered in the use of rape-cake is that the cattle dislike its taste; and if they are supplied with a full quantity of turnips or straw, they will consume just a sufficient quantity of these foods to maintain an average weight, and reject the rape-cake offered them. The way in which this is to be avoided is a very simple one. Of course it will not do to diminish the quantity of other nutriment given to the cattle, for that would defeat the objects of the feeder. But a part of the more bulky food, such as turnips, must be replaced by some substance, such as grain, containing the same amount of nutriment in a smaller bulk, and then the craving for a sufficient quantity to fill the stomach will induce the animals to consume the rape, and after a few days they become completely accustomed to it.

The comparison with one another of the different kinds of food, as an economic question, is too much a matter of detail to be entered on here. I have particularly insisted on the effects obtained from the use of rape-cake as an example, because theoretically it is equal to oil-cake, which costs not far short of twice as much. No doubt there are other kinds of food, such as Indian corn, &c., which might be very profitably employed. But cotton-seed cake is almost the only large addition to the list of our feeding substances within the last few years; and, provided it be well prepared, and the husk separated, it is a very valuable food, although it differs very much in quality, and must be used with caution. It is important that all kinds of oil-seeds should be imported into this country, and the quality of the cake they yield ascertained.

The subject of the feeding of stock as a branch of farm management would be incomplete did I not refer to the value of the manure produced. I have already adverted to the often-expressed opinion that cattle are little better than manure-making machines; and though few experienced feeders will be inclined, at

the present time, to adopt that dogma in its integrity, it points to a subject of no small importance, and on which great difference of opinion has existed, and still exists. The question to be solved is, how much of the price of any kind of food is to be laid to the account of the manure produced. It is well known that the most varied opinions have been expressed by practical men on this point; and in the case of oil-cake and similar substances, it has been not uncommon to calculate that half, or even two-thirds, of its value are to be placed to the dung, although this estimate does not appear well founded. The experiments already quoted afford information from which some conclusions may be drawn. Wolff, who prosecuted a very careful set of experiments, supplementary to those just referred to on this point, has ascertained that from $\frac{5}{6}$ to $\frac{7}{8}$ of the manurially valuable constituents contained in rape-cake appear in the excretions of the animals using it as food On the other hand, if we estimate from Messrs Lawes and Gilbert's experiments in regard to the quantity stored up within the animal, and assume that the difference between this and the matters contained in the total food must pass into the excretions, the inference is that $\frac{18}{20}$ of the nitrogen, and $\frac{28}{30}$ of the mineral matters, must be contained in the dung. If, however, not to press the matter too far, we abide by Wolff's conclusion, that $\frac{7}{8}$ are obtained in the dung, it is easy to calculate its manurial value in the ordinary way. If rape-cake be selected as an example, it appears that every ton of that substance will produce in the dung a quantity of ammonia, phosphates, and alkalies, which, estimated at the usual prices attributed to these substances, in guano and other artificial manures, must be worth about £3, 10s., or more than half its value. As, however, rape-dust is frequently employed as a manure, it may be urged that, in reality, this estimate, though correct for guano, is too low in the present case, and that $\frac{7}{8}$ of the price of the rape-cake must be the true value. On the other hand, it may be maintained that rape-dust is an expensive manure, which is only used in special cases, and that in general a cheaper substance may be used with equal advantage. It is not easy to decide which of these modes of viewing the value is most entitled to confidence; but we shall probably not err very greatly if we assume that $\frac{3}{4}$ of the value of the rape-cake is excreted. In regard to oil-cake, which is much dearer as food than rape, it must be remembered that, though the same proportion of its valuable matters will remain in the manure, they will not be more valuable as manure than they are as the latter substance; so that, when oil-cake at £10 or £11 per ton is used, not more than a third, or at most a half, of its value can be considered to pass into the manure. Of the cereals, in all probability the value of the manure produced is not more that a third or a fourth of the grain. These calculations are based on the assumption that the whole of the matters passing

into the manure are retained there and applied to the soil without loss—a condition which cannot be fulfilled in practice, partly because the whole of the excretions cannot be collected, and partly because the manure is exposed to many sources of loss. When a ton of rape-dust is directly applied to the soil, we know positively that there is no waste; but when it is used as food, although $\frac{7}{8}$ of its valuable matters are excreted by the animal, it by no means follows that they are all there when it is used as manure. On the contrary, we are well assured that there must be a loss, and hence all the estimates above given must be above rather than under the truth. Any attempt to discuss the amount of the loss accruing in this way would lead us into the consideration of the general management of farmyard manure, which would be entirely foreign to our present subject. Enough has been said to show that the value of the manure must be a very important addition to the profit of any feeding operations.

I shall not attempt to enter upon the discussion of the profit to be derived from the cattle themselves, that being a point which must necessarily depend upon many matters in addition to those already discussed, and would carry us into details quite unsuited to an occasion like the present. My object has been to treat the subject, not in its commercial aspects, but rather to show that the feeding of cattle is an art founded upon scientific principles, the proper application of which have an important bearing upon its economy. Reference to minutiæ and to particular cases, besides carrying us far beyond the limits of such an address, could not be made either interesting or instructive on such an occasion; but any one who takes the trouble fairly to consider the principles, will find no difficulty in applying them to any case which may arise in the course of his practice.

FARM MANAGEMENT:

Report on a Mode of Managing a Farm, affording an Example of High Farming combined with Profit.

By Alexander Simpson, Teawig, Beauly.

[Premium—The Gold Medal.]

In presenting the Report contained in the following pages, the writer is not prepared to say that its contents elucidate (in the words of the Society's Premium List,) "the *best* mode,"—he is satisfied with offering a report describing *a* "mode of managing a farm, affording an example of high farming combined with profit."

To entitle a report on this subject to consideration and confidence, I believe that what is required is not an estimate of *probable* returns from *supposed* expenditure (these, when tested by experience, almost always prove fallacious), but a *bona fide* return of the expenditure and receipts of a farm in working order. This I give in a form which I conceive will be intelligible to the reader least conversant with book-keeping, while I believe it will be received by those versed in figures as a fair business statement of the accounts of a tenant-farmer. As such, indeed, I confidently present it. Not unacquainted with business prior to engaging in my present occupation, I keep regular accounts as a matter essential to farming as to every other business; and the profit-and-loss account presented at pages 182-184, is simply a transcript of my own books, with the exception of one entry which I have, for reasons fully explained, amended.

The accounts given are those for the crops of 1856 and 1857. Situated as my farm is, on the north-eastern coast of Scotland, I shared fully in the disasters attending the harvests of those years—which will long live in the memory of Scotch farmers. Much corn was totally lost by the opening up on the fields of the drenched stooks, more was deteriorated to a large degree by discoloration and sprouting; while the harvest work being protracted was necessarily expensive. The potato disease was also very destructive in its

effects during both years. An exposition of the results of these two years is, I feel, putting profitable farming to a most severe test —a test which, perhaps, in general, it could not stand, and which, in my own case, it does stand only from my following a more diversified system of cropping than that afforded by the standard four- or five-course shift.

The total acreage on which I report is 313: of these, 4 are occupied by houses and buildings, and 10 by banks and belts of plantation, not capable of cultivation, and of little or no value for pasturage, leaving 299 acres of arable land, which were cropped as follows in the years 1856, and 1857:—

	1856. Acres.	1857. Acres.
Wheat,	69	82
Barley,	39	12
Oats,	32	50
Total cereals,	140	144
Beans,	0	5
Potatoes,	24	27
Do. for cottars, &c.,	3	$2\frac{1}{2}$
Mangold,	0	$1\frac{1}{2}$
Turnips,	57	38
Turnips sown for seeding,	5	14
Turnip seed,	0	5
Fallow after turnip seed,	8	0
Tares for cutting,	0	2
Grass in rotation,	54	53
Do. in permanent calf, &c., parks,	5	5
End ridges, and uncropped,	3	2
	299	299

The Expenditure and Returns for the crops of these years are given in the following account-current:—

Dr. FARM. CROPS 1856 and 1857.

1856.			
June 1.	To valuation of live stock—viz.,		
	Horses,	£262 0 0	
	Cattle,	352 10 0	
	Sheep,	134 15 0	
	Pigs,	36 0 0	
			£785 5 0
1858.			
June 1.	To purchases of Horses,	£98 15 0	
	Cattle,	137 5 0	
	Sheep,	100 19 9	
	Pigs.	8 14 0	
			345 13 9
	To cattle-feeding stuffs purchased,		97 13 8
	Carry forward,		£1228 12 5

Dr. FARM—*Continued.*

1858.	Brought forward,		£1228 12 5
June 1.	To general farm expenditure for 2 crops under the following heads—viz.,		
	Rental,	£975 7 2	
	Rates and assurances,	43 1 10	
	Yearly servants' wages,	240 8 0	
	Do. provisions,	308 15 2	
	Labour by outworkers,	370 15 0	
	Seeds of all descriptions,	500 11 0	
	Manures,	413 16 9	
	Bran, &c., for horses,*	71 12 0	
	Tradesmen and charges,	215 19 5	
	Implements purchased,	56 4 9	
	Improvements and lime,	130 2 10	
			3326 13 11
	To $\frac{2}{11}$ths of expense of improvements of thrashing-mill in 1856.—See page 185,		9 12 3
	To crop 1858—Rental and charges on 14 acres turnip seed, harvested July 1858, proceeds to crop 1857,		35 0 0
			£4599 18 7
	To balance, being profit on the investment, including interest on capital,		548 16 2
			£5148 14 9

Cr. CROPS 1856 and 1857. *Contra.*

1858.			
June 1.	By cash sales during 2 years—of		
	Cattle,	£412 9 1	
	Sheep,	224 8 1	
	Pigs,	138 9 2	
	Total live stock,		£775 6 4
	Wheat,	£984 18 10	
	Barley,	478 4 9	
	Oats,	269 2 3	
	Total corn,		1732 5 10
	Potatoes,	£457 1 1	
	Turnips to sheep,	133 6 10	
	Turnip seed,	337 10 10	
	Grass, hay, &c.,	40 7 9	
	Dairy of 12 cows,	122 11 9	
	Total from green-crop land,		1090 18 3
	Total cash sales,		£3598 10 5
	By corn, &c., &c., used for seed, servants' provisions, and household supplies,† under the following heads—viz.,		
	Wheat,	£164 12 3	
		164 12 3	
	Carry forward,		£3598 10 5

* This head does not include home-grown corn used for horses. Bran is used to a large extent as food for the working horses. The lighter oats go for feeds when at full work; and tail barley and wheat for boiled messes. On these, and on the grass, tares, and hay used, it would be difficult to set a value; indeed, practically, it would be difficult to give an exact account of the quantities consumed; and as they are used up in working the farm, an account of them would only be useful to show the gross produce, but would not in any way affect the balance-sheet.

† The total amount included under the head "Household Supplies" does not

1858.	*Cr.* *Contra*—Continued.		
June 1.	Brought forward . .	£164 12 8	£3598 10 5
	Barley, ...	13 8 9	
	Oats, ...	202 6 10	
	Beans and tares, . . .	6 17 6	
	Potatoes, ...	159 8 8	
	Turnip seed, and rent of land occupied by,	32 8 0	
	Rye-grass seed, . . .	10 14 0	
	Dairy, ...	63 3 4	
			652 14 4
	By valuation of live stock—viz.		
	Horses, ...	£320 0 0	
	Cattle, ...	410 0 0	
	Sheep, ...	140 0 0	
	Pigs, ...	27 10 0	
			897 10 0
			£5148 14 9

The foregoing account might be epitomised as follows :—

Dr. FARM. CROPS 1856 and 1857. *Contra* *Cr.*

To Ordinary Expenditure for 2 years, as follows—viz.,		
Rental, Rates, &c.,	£1018 9 0	
Labour, Tradesmen, and Charges,	1135 17 7	
Seeds, ...	500 11 0	
Manures, . . .	413 16 9	
Depreciation in value of, and food bought for horses	112 7 0	
		£3181 1 4
To Extraordinary Expenditure—viz.,		
Implements, . .	£65 17 0	
Improvements and Lime, . . .	130 2 10	
		195 19 10
Total Expenditure,		£3377 1 2
To Balance for Profit and Interest, ...		548 16 2
		£3925 17 4

By Produce for 2 crops of		
Wheat, . . .	£1149 11 1	
Barley, . . .	491 13 6	
Oats (besides horse corn), . . .	471 9 1	
Total Cereals,		£2112 13 8
Beans, Hay, &c.,	£57 19 3	
Turnips to Sheep,	133 6 10	
Potatoes, . . .	616 4 9	
Turnip Seed, .	334 18 10	
Profit on Live Stock (deducting purchased food),	670 14 0	
Total Grass and Green-crop Land, . .		1813 3 8
Total Returns,		£3925 17 4

The purchased manures amount to 14s. per arable acre per annum. Including purchased feeding-stuffs, the expenditure amounts to within a fraction of 20s. per arable acre per annum.

This is a rate of expenditure which may fairly be held to characterise a system of "high farming;" and the writer is rather inclined to exceed than to fall short of a similar liberal expenditure in future years.

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exceed £50 in two years, so no great error in over-estimation can have been made. The provisions used in kitchen are all charged to "Servants' Provisions," per contra; and the portion used by the female servants is considered to meet the value of their services in dairy work, their money-wages going in cash-book to the account of "Household and Personal Expenditure."

The Gross Returns are	£6 11 3	per acre per annum.
The Rental is . . . . which, when the soil, &c., as described in pp. 189-192 are taken into account, will be considered a high rate.	1 12 7	" "
The residue to the tenant is	0 18 4	" "

The foregoing accounts are not accounts "cooked" for the occasion, but, as has been already stated, are faithfully taken from the business books of the farm, and were kept without any view to their condensation into a published statement.

Having thus given, in accordance with the requirements of the Society, an account of "*the expenditure and returns*" of the farm reported on, I now proceed to explain, also in accordance with those requirements, "*the mode of accounting*" which I follow.

It is very simple. The term of old Whitsunday (for convenience say 1st June) is the time of balancing the year's accounts. By this time the corn of the past season is all thrashed, and either sold or in granary. It is not valued over to the next crop, the actual returns when sold being the credit to the crop it belongs to. The winter stock of cattle, sheep, &c., are then either sold, or valued and turned over to summer grazing.

The seed-corn, &c., sown, is credited to the past, and charged to the incoming year at its fair value, as will be seen at the debit and credit of the foregoing balance-sheet.

The farm-work performed, the manure and straw, are not brought into account. Transferring accounts of tillage, &c., from one year to another, is an unnecessary complication, as there can be very little difference between one year and another, under one system of management; and the valuing of ploughings, cross ploughings, harrowings, and grubbings, only serves to confuse and mislead, except in the case of a change of tenancy. In like manner the stock of straw and manure, at any particular period, varies but little from year to year.

Implements, also, do not require to be annually valued; for it will be found that, to keep up with the improvements of the day, new purchases must be made to an extent sufficient at least to balance any per-centage that would be required for deterioration on the old stock. It will be observed that £56, 4s. 9d. were thus expended during the two years reported on; and here it may be observed that, so strictly had this rule been observed, that an amount of £52, 18s. 6d., paid for attaching horse-power machinery to the water thrashing-mill, was charged against the then current year (1856); but on further consideration it appeared but right that this charge should be spread over eleven years—the unexpired term of the lease—any sum to be received at its termination for

the machinery being considered as equivalent to the compound interest on the expenditure.

Improvements effected during the year are also put down to current expenditure—not capitalised. Such will, in the ordinary operations of a farmer, be found necessary in the way of additional draining, or making up defects in that already executed, and in additions to, or alterations in, office-houses. These *ought* to be done by the landlord, but, practically, during the currency of a lease, they generally fall on the tenant. For such, and for the improvement of the land by liming, it will be seen that a charge of £65 per annum has been incurred.

There remains to be noticed the valuation of live stock.

Horses may in some sense be considered as part of the outfit of the farm, and might be classed as part of the "Capital Account." But considering that, on the one hand, deterioration by age necessarily does occur, and that considerable deterioration may take place from accident or disease; and, on the other hand, that by rearing young horses the value may increase instead of diminishing from year to year, irrespective of purchases made, it becomes necessary to re-value them at stock-taking, in the usual way, before striking a balance.

In regard to the other descriptions of live stock there can, of course, be no question as to that being the plan to be followed. In affixing a value to the live stock, every care has been taken to arrive at a fair value; and as the foregoing accounts were made up for private use, and not for publication, there could be no object but to make them as accurate in this respect as the judgment of the writer would allow, without calling in the assistance of others. When the valuation is made, he has as clearly in his view the profit-and-loss account of the crop growing as of that closing, and hence the scales are held equal. In the employment of valuators the same knowledge of the stock, its capabilities or antecedents, could not be expected,—the same individual could not always be secured, and difference of judgment, caprice, or inattention, might occasion discrepancies in valuation which would be very embarrassing to one keeping accounts, as has here been done, not with a view to publication, but for his own information and guidance.

It is, doubtless, somewhat bold in a tenant-farmer, of whose lease a considerable portion has expired, thus to come forward with not only the statistics of his occupancy, but also with full details of its money results. I believe, however, that by the close and jealous reserve generally observed by those of my profession in this last respect, a great deal of misapprehension is occasioned. I believe that landowners are more disposed to over-estimate than to under-estimate the profits of farming. The figures given above can do no harm in our relations with them; they show, as will be seen

hereafter, but a very moderate per-centage on capital invested. Again, tenant-farmers, from the want of keeping accounts, are apt to under-estimate their profits. Because the "balance in the banker's" is not increased from year to year, they are apt to conclude and to assert that "farming is a losing business," although in the mean time their personal and household expenses have been defrayed, and in most cases a progressive improvement has gone on in the value of their stock and condition of their occupancies.

But it may be said that I have not given a fair view of the results obtained by myself, and therefore no correct *data* for estimating those of others, from having selected as my years of exposition two in which bad harvests were experienced. But here there were compensating influences at work. "Necessity is," proverbially, "the mother of invention;" and the urgency of rent-day, and labour and manure-bills, causes expedients to be resorted to, which, in more prosperous times, would not be thought of, or, if thought of, put aside as "troublesome." Thus, sprouted grain may put pigs more forward in the balance-sheet than they would otherwise have been; damaged straw may cause the opinion that cattle will not make much of the turnips to be given in connection with it, and these turnips may be turned to an account in raising turnip-seed, which tells in the balance-sheet, and at the factor's audit; a failure in the potato crop may make a particular variety, which has comparatively escaped, a matter of profit from seed demand, considerably beyond the ordinary rate. So important were those influences in the years reported on, that I believe I would not be safe in calculating for future crops—exempt from harvest disasters and potato failure—a much larger balance to the credit of the profit-and-loss account than has been given above; a balance which, as already stated, will be found a very moderate return on capital invested.

This brings me to consider at what that *capital* should be stated. Here I am free to confess that I experience much difficulty. As will be understood from a description of the land I occupy, to be given hereafter, a large proportion of it was entered upon when it was in the very lowest state of exhaustion. Much work, in the shape of permanent improvement, was executed in the way of draining, building office-houses, &c. Thus it was at least a full rotation before the land was even in fair working order. During this period the "capital account" could not, of course, be closed; and when these derangements were put right, and fair working condition arrived at, the intricate question presents itself, "When profit on capital should commence to be computed?" If from the beginning of the investment or adventure profit were to be added to capital, then too heavy an enhancement would be made of the "Capital Account." Moreover, impartial reconsideration of past expenditure might show that a good share of it was chargeable rather to "*inexperience*" than to "*capital*." To disentangle

these two items would be a task puzzling to the best farmer-accountant, and I shall not undertake it. I believe that a fair valuation of the farming investment, as it now (October 1858) stands, is the most correct view of the "Capital Account" on which profit is computable; and I may add that, assuming the following to be a correct view of the immediately available value of the investment —which I believe it to be—the investment has, on the whole, turned out very fairly as to the past.

ESTIMATE OF FARM VALUATION, OCTOBER 1858.

Live Stock as at 1st June 1858, . . .	£897	10	0
Increased value thereof, from pasturage to date, .	100	0	0
Implements and mill machinery, . . .	400	0	0
120 acres corn crop, average per acre £8, . .	960	0	0
25 acres potatoes and winter beans, per acre £15, .	375	0	0
6 acres mangold, per acre £10, . . .	60	0	0
42 acres swede and yellow turnips, per acre £8, .	336	0	0
12 acres turnip seed, contract, . . .	200	0	0
Hay stacks, 30 tons £3, ...	90	0	0
	£3418	10	0

This is an "above-ground" valuation. An "under-ground" valuation of unexhausted manures and improvements might be entered upon; but it would be at the best but suppositive, and dependent on unknown conditions of prices. I shall therefore not add it to capital; though assuredly I would not part with it at less than one thousand pounds.

Assuming, therefore, that the "Capital Account" stands at the above sum of £3418, 10s., the profit for two years appearing as £548, 16s. 2d.—*i.e.* £274, 8s. 1d. per annum, I have an annual return for superintendence, risk, and interest, of *eight per cent.*

This is not equal to the profit expected on capital employed in mercantile transactions, where 10 per cent is calculated upon as the fair return upon capital invested. But a farmer is engaged in what has well been termed by the wise and great Washington "the most healthful, the most useful, and the most noble employment of man;" he should, therefore, be satisfied with a less annual return upon his capital than is reaped (or expected to be reaped) by his friend who, "in populous cities pent," passes his anxious days in the whirl of commerce. He has, moreover, this to counterbalance his more moderate profits, that he has a house and garden rent free, and also a horse and vehicle, which, occasionally employed as part of his business outfit, is at all times a matter of personal and family accommodation, which, to commercial classes, it would cost a portion of their "profits from trade" to obtain.

DESCRIPTION OF THE FARM REPORTED ON.

It lies on the eastern side of Scotland, in the valley of the Beauly Frith, and on the confines of the counties of Inverness and Ross.

It consists of two separate holdings, of the respective sizes of 180 and 119 acres. They are both held under current leases of 19 years' duration. They are situated at rather more than two miles distance from each other, and have separate steadings and resident servants; but are practically worked as one farm. Horses and servants are transferred between them as the arrangement of work may require; stock also, as the consumption of grass and winter food may determine.

There are advantages, and also disadvantages, connected with this division of the land. The first are, the less length of the cartage between the fields and the steadings—the moderate size of the fields, averaging 18 acres each—and some emulation between the resident servants at each. The disadvantages consist chiefly in the dislocation of work, by the ordinary carrying on of it by two small parties instead of one larger united band. On the whole, I think that, by it the item of labour in the expense account is somewhat increased, while the horsework is economised. thus the advantages and disadvantages about counterbalance each other.

To the holding of 119 acres, situated at about 20 feet elevation above the sea-level, having the river Beauly as its southern boundary, the following description and remarks, forming part of a contribution on the subject of "Draining" to the columns of the *Agricultural Gazette* in 1855, apply:—

"A specimen of the soil and subsoil having been submitted in the year 1845 to Professor Johnston, he furnished the following analysis, appending thereto some valuable remarks and instructions (partially quoted below), which have been of much service in directing the processes of culture and management followed out. Analysis of—

		Soil	Subsoil.
By Washing—	Clay, fine sand, and organic matter,	93.07	97.12
	Coarse sand and small stones,	6.93	2.88
By Analysis—	Organic matter,	10.10	2.44
	Alkaline salts, soluble in water,	0.91	0.15
	Gypsum, sulphate of lime,	0.19	Trace.
	Oxide of iron,	3.32	3.70
	Alumina, soluble in acids,	2.13	2.41
	Carbonate of lime,	1.32	0.47
	Carbonate of magnesia,	0.87	0.61
	Insoluble silicious matter,	81.17	88.25
		100.01	98.03

"'*Remarks.*—It is a stiff clay soil, formed, as your geological position would intimate, from the *debris* of the mica-slate-rock, with a little assist-

ance from the granite and old red sandstone. The proportion of oxide of iron, derived chiefly from the latter, is not excessive; and in a proper condition of the soil, properly drained, thoroughly opened, and well tilled, would add to its productive character. But I observe that this oxide has formed itself into little lumps, indicating an unwholesome condition of the soil—that the air is not properly admitted, and that there exist among the soil particles of ochrey matter with which it will not be wholesome for the roots of plants to come in contact. The small quantity of organic matter in the subsoil would seem to imply that it has been hitherto in a condition in which very few roots would willingly descend into it. These facts all recommend thorough drainage and subsoiling as necessary to render available to the plant the different kinds of food which the soil so abundantly contains.'

"These remarks were written in July 1845. Perhaps their accuracy could not be better supported than by the simple statement that the wheat crop of the outgoing tenant for that year was estimated by valuators at 14½ bushels per acre; an estimate which was somewhat in excess of the produce actually harvested by me, the incoming tenant. The whole farm has been thoroughly drained, and the effects are very satisfactory—the produce being now in the aggregate fully threefold of what it was prior to draining and deep tillage, though the ochrey matter which the learned Professor described as 'not wholesome for the roots of plants to come in contact with,' is not yet quite washed out or neutralised: hence the produce of wheat and oats disappoints expectation, while green crops are satisfactory.

"When I began draining, Smith of Deanston's system of furrow draining was beginning to be accepted by the more advanced agriculturists as a proved and practicable improvement; and his plan of 2½-feet drains filled for a foot with broken stones, was the perfection of drainage engineering. Such was the system followed in the major part of the drainage I effected. My first change was to 3 feet depth with 8 inches of broken stones, then came tiles with boards below for soles, and broken stones above. It was in 1848 that I put down the first pipe-tiles, 3 feet deep. Increasing that depth to 3½ feet, and placing 1½-inch pipe drains in the line of greatest descent at intervals of 8 yards, we attain to what may well and truly be termed 'thorough drainage.'

"Drainage on each of these systems has, I must say, been efficacious, whatever preference I may give to one system over another. No water, even after heavy rain, lies for above a few hours on the least perfectly drained field. It is true that the run through the stone drains is not so rapid as it is through tiles, but those who have scanned the results obtained by one of the most skilful and successful of Scottish agriculturists, Mr Hope of Fenton Barns —which are largest from land drained on what the enthusiasts for deep draining would consider very faulty principles—are cautious about trying to 'make good better' by going again over their drained ground; therefore I am content to allow my land stone-drained, at 2½ and 3 feet depth, to lie as it is."

On this holding the work done on or to the land has been furrow-draining, as above described; the building with stone conduits, and filling up of upwards of 2000 yards of wide open ditches; the levelling of old fences and grubbing up of thickets, which formerly rendered useless 5 acres of ground, and impeded the straight

working of the fields. These labours cost about £600 for hired labour, besides much work by the servants and horses of the farm; a part—£375—of this was money obtained by the landlord's co-operation, under the Government Drainage Loan Act, for which the full interest of 6¼ per cent is paid by me, and classed in the accounts under the head of rental. Subsoiling; the use of lime, pure and in composts (principally the latter); the application of guano and other portable manures, are the further means used in each year for the improvement of the soil of this holding, BUT IT CONTINUES A DEAF SOIL. Iron is still abundant "in an unwholesome condition," and practical farmers know well that such a soil is more productive of straw and weeds than of corn.

A steading, including water-power mill and mill-dam, was erected by me at my own expense, with the exception that wood and slates were furnished by the landlord. This, with the refitting of the dwelling-house, also done by me, cost little less than £500.

Of the other holding, 120 acres are in a flat, reclaimed by embankment from the Frith. All this land is below the level of high water. The drainage water is collected in open ditches surrounding and intersecting the flat, and discharged at low-water by sluices through the embankment. When the land was reclaimed about thirty years ago, it was a perfect swamp, not merely from the influence of overlying water from tides, but also from spring-water; for, lying as it does immediately at the foot of a gravelly terrace of land extending back for several miles without any natural drainage outlet, the water of filtration through this large extent rises to the surface through the flat. This rising water was originally taken from the fields into the surrounding ditches by drains formed of brushwood. These, of course, soon decayed, and were replaced by drains formed either of stones from the gravel, three to six inches in diameter, or of split trees laid triangularly together. These, again, became unsatisfactory, and are still the cause of much annoyance from frequently bursting out. Since the commencement of the present lease, the land has been gone over again, and £394 advanced by the landlord (interest on this at 6¼ per cent is also paid and included in the rental charge) has been expended in thorough pipe drainage—the leading drains being constructed of stones, the rejected cuttings of a large red sandstone quarry in the immediate neighbourhood. The outfall is so defective, even at low water, that three feet is the utmost depth that can be attained, and there is expense continually incurred by the silting up of the pipes and the breaking out of the old wooden drains. The containing-ditches are also difficult to keep clean, as the current is very languid, and water-weeds grow rapidly and choke them.

This flat is of a peaty soil, lying on a subsoil of bluish alluvial sand, with occasional veins of diluvial clay through it; and it

also is charged with an unwelcome superfluity of ochrey matter, giving it a similar character to the previous division—namely, that of "*a deaf soil.*"

The other 60 acres of this holding are on the gravel terrace, about 40 feet above high-water mark. They consist of thin sharp soil, giving good returns in "dropping years," but easily affected by drought and overworking.

The buildings on this holding, including water-power mill, were completed by the landlord, and are on the whole commodious, though they have required changes at the tenant's expense (witness £52, 18s. 6d. for horse-power machinery to mill) to suit them to his requirements.

MANAGEMENT.

The two divisions of 120 acres each are managed on a six-course shift, say—

1. Grass.
2. Oats.
3. Green crop: potatoes, beans, swedes, mangolds.
4. Wheat.
5. Turnips.
6. Barley or wheat: sown out with grass.

It is a rule to give a heavy farmyard manuring to No. 3. of the course, supplemented by guano or a mixture of it with dissolved bones. By the aid of composts more or less of No. 5 is gone over with manure, and it receives a liberal supply of portable manures in the turnip drills. If wheat follows, that is put down with as much farm manure as can be gathered together in the autumn.

The terrace or gravel land is managed on a five-course shift—

1, 2. Grass pastured.
3. Oats.
4. Potatoes, or turnips eaten off by sheep.
5. Barley.

This is a hungry soil, and swallows up much farmyard manure without making much return for it. Dissolved bones are most relied on for its fructification.

The above is the general course of management, but some derangement in its rotation has been caused (as will be seen by the acreage cropping at page 182) by the practice recently followed of raising some acres of turnip seed on a contract with respectable seedsmen. That practice also involves, to some extent, the curtailment of the live stock, and a consequent increase in the manure account. In other respects I do not think it involves impoverishment of the soil. The land in the end of July is in your hands free of crop; and that crop, as carried away, has consisted of—say 12 cwt. of seed for two years' growth. To restore the constituents of that by farmyard or artificial manure is no difficult task. You

have the land cleaned and manured before the commencement of harvest work, with the rotation, as it were, at your command, to begin with wheat or whatever other crop you please. I have found it advantageous on clay soil to follow a crop of turnip seed by one of winter beans. These can be sown in early autumn, so as to have well-established roots before winter sets in, and thus they ripen in July or August, and are not troublesome and precarious to harvest, as are spring-sown beans in late seasons.

The portable manures used during 1856 and 1857 consisted almost entirely of first-class Peruvian guano, and bones dissolved by myself in sulphuric acid. The quantities used were—

	1856.	1857.
Guano—cwt. . . .	230	76
Bones for dissolving—bushels, .	252	668

It will be seen by this statement that the extravagant price put upon Peruvian guano has much limited my use of it. If sold at £10 to £11 per ton, I would use it to the extent of 4-5ths of my expenditure, as there can be no question that it approaches nearer to a perfect manure—*i. e.* one available for every crop and every soil—than any other.

The live stock on the farm as now (October 1858) settled for the winter, consists of—

13 Cows (crosses).
1 Short-horn bull.
12 Two-year-old cattle for feeding.
13 One-year-old do.
12 Calves of this year.
90 Ewes and 2 Leicester tups for early lambs to sell off.
30 Half-bred lambs to fill up stock.
1 Boar and 3 breeding sows, with their last and present litters.

About eight acres of turnip will be let for sheep-feeding. This is not a paying practice—giving usually less than £6 per acre; but it sweetens and improves the ground when practised once in each second rotation—*i.e.* in each ten or twelve years.

The labour is performed by the following permanent servants—viz.:

Two working grieves.
Five ploughmen.
Three lads for cattle and sheep.

Extra male labourers are employed as required about ditches, dungheaps, and composts. Women workers do the green crop and barn work under the grieve's supervision, and also the principal part of the harvest work, which is all done by the sickle, except the oats, which are cut by the scythe.

The men have cottages, each of at least two rooms, on the farms.

They are on yearly engagements, and, calculating the provisions they receive at wholesale prices, they receive, including their money wages, but exclusive of rent on their houses, £28 per each ploughman; the grieves, of course, receive considerably more. The boys are fed in the kitchen.

Five pairs of horses are employed, five mares and five geldings. These perform all the tillage of the farm, and also the delivery of the grain and potatoes grown, the larger portion of which—say, at least, two-thirds—are delivered at a distance of 11 miles from the steading, being the nearest seaport and railway station. A horse for riding and driving is, of course, kept, as part of the business equipment of the farm. I have been unfortunate in rearing young horses, and I believe chiefly from the cause that the stud-horses travelling in the district are overtasked with mares. It will be observed that a considerable sum (£98, 15s., which is after deduction of old horses sold off) is charged for horses purchased; and but one young horse is rearing up on the farm.

I have thus given, in accordance with the requirements of the Society, a full description of the farm, pp. 189-192, and described the system on which it has been managed and cultivated, pp. 192, 193; the improvements effected, pp. 190, 191; stated the expenditure and returns, pp. 182-184; and explained the mode of accounting, pp. 185, 186.

I am further instructed by the Society's Premium List "to consider how much extra or imported manure is required to maintain in high condition a farm of 300 acres cultivated on a four-course shift, when potatoes forming one-half of the green crops and the grass made into hay are both sold off the farm."

Before giving a reply to the question thus put, I would observe that the course of cropping pointed out—namely, a four-course shift—is by no means the best that could be adopted for the development of high or even good farming. It gives but one cleaning in four years to the land, one manuring also. It likewise brings the grass crops into such close proximity to each other that the red clover, the successful growth of which is, if not indispensable, at any rate highly conducive to the fruitfulness of the soil during the rotation, has but small chance of succeeding. Moreover, the two cereals, wheat and oats, will not, manure and cultivate as we may, give their full produce when revolving in such a close and narrow round. The course of cropping pointed out would appear as if intended to meet the case of close proximity to a town or city, where town manure can readily be obtained by purchase, and a high price got for early potatoes and for cutting grass and hay; but I believe that this is precisely the situation in which the cultivation of green crops should preponderate. They are, in such a situation, considerably more money-producing than grain crops;

and though these are also necessary, I conceive that in such districts *corn crops should be grown to facilitate the growth of green ones;* as in more distant districts green crops are grown preparatory to grain ones.

The rotation I would consider most appropriate for such a situation is a five-course shift of this nature:—

1. Turnips, swedes and yellows, and mangold.
2. Potatoes.
3. Wheat.
4. Clover-grass.
5. Oats.

Or, viewing the facilities in such a district for the disposal of dairy produce and of early lambs, I would be inclined to make it into a six-course shift by continuing the grass as a pasturing crop for a second year, in which case there would be sown, along with Italian rye-grass and red and alsike clovers for the first year's cutting, a mixture of seeds for second year's pasturing. The only objection is the distance of time between the cleaning crops, which, leaving an interval of three unfallowed years, might tend to make the land foul; but, as the two green crops follow in succession, an opportunity is afforded of thoroughly destroying every root-weed; and if surface or annual weeds are feared, they can be kept down by drilling the corn and hoeing it either by hand or machine. I think that even an improvement would be made on this course by taking barley after the wheat preparatory to laying down with grass. It would then stand a seven-course shift; thus—

1. Turnips and mangold.
2. Potatoes.
3. Wheat.
4. Barley.
5. Clover-grass for cutting.
6. Pasture.
7. Oats.

Following out, however, the instructions before me, I take the case of a farm of 300 acres on a four-course shift; say—

75 acres grass cut for hay.
75 „ oats.
38 „ potatoes.
37 „ turnips, mangolds, cabbage, and carrots.
75 „ wheat.

I would apply to the grass, in March, 2 cwt. Peruvian guano per acre; and in April or early May, when showers are falling, 1 cwt. nitrate of soda. An early and a heavy cut of grass for home consumption by horses and soiling cattle, and for making into hay, would

thus be obtained. Thus treated, I would calculate on a good aftermath, to be either sold or used in the yards, followed by a rich sward for sheep, up to Christmas. It would then plough down for oats, with the prospect of a heavy crop, without any further addition of manure.

I would manure the potato and turnip breaks well, so as to have a full produce from them, and the land ready, without further manuring, for the autumn wheat crop; storing the turnips, &c. early in November. I believe that if a moderate portion of oilcake or other feeding-stuffs is used along with the turnip and mangold, &c. produced, in feeding cattle, the oat-straw may be consumed, and the wheat straw trodden into manure; that thus sufficient "muck" (the farmer's surest friend after all) will have been produced at home to give 20 loads per acre to all the green-crop break.

I would give the potatoes at planting 2 cwt. superphosphate and 1 cwt. Peruvian guano per acre, and top-dress them with 2 cwt. Peruvian guano at the first hand-hoeing. This practice I have found by experiment to give the largest produce. To the turnips, &c. I would give 2 cwt. superphosphate and 3 cwt. Peruvian guano per acre at sowing, adding to the mangold 5 cwt. of common salt.

Thus treated—of course presuming careful culture in other respects—I have no doubt that even under a four-course shift "the land would be maintained in high condition," though I question, for the reasons already explained, whether the produce would be so high of any crop as it would be under a more extended rotation.

We would, adopting the practice thus suggested, have a total use of purchased manure to the extent of

375 cwt.	Peruvian guano, at 12s., ...	£225	0	0
75 „	nitrate of soda, at 18s.	67	10	0
150 „	superphosphate, at 7s., ...	52	10	0
30 „	salt (6 acres mangold) at 1s., . . .	1	10	0
		£346	10	0

Or a little more than 23s. per acre. This, though it may appear a high, would, under the circumstances suggested, be, I believe, a wise, safe, and profitable rate of expenditure.

REPORT ON THE CAUSE OF FINGER-AND-TOE IN TURNIPS.*

By JAMES DUNCAN, Old Manse, Denholm, Roxburghshire.

[Premium—The Gold Medal.]

THE existence of the disease now so familiar to farmers under the name of finger-and-toe, is probably coeval with the introduction of the turnip into field cultivation. As the latter began to extend, and assume some degree of the importance which it was afterwards destined to attain, it showed itself in a more general and decided form, and began to attract attention from the necessity that was felt of endeavouring to discover some remedy for it. Hitherto, however, its ravages have been but very partially checked, and its extent and virulence have probably never been greater than at the present time, when it constitutes, if not the only, at least by far the most formidable enemy with which this invaluable crop is liable to be assailed.

Much of the obscurity which is apt to attend the diseases of plants, and of which we have had, of late years, memorable examples in the maladies that have affected the potato, the vine, the larch, &c., likewise attaches to this disease of the turnip; and the numerous investigations to which it has been subjected, have thrown but a very partial and unsatisfactory light upon it. Nothing, indeed, can be said to have been ascertained beyond the external manifestations of the disease, and some of the circumstances which commonly attend its appearance. Not only has the *cause* of it remained unknown, but it has seldom been the subject even of probable conjecture, while, not unfrequently, the investigation of it has been altogether abandoned, under the idea that it is beyond the limits of ordinary scrutiny. Chemistry fails to detect any material alteration in the elementary constituents of the diseased plants; physiology cannot explain the changes that must take place in the structure of the tissues and action of the juices; and pathology is reduced to a bare description of the morbid appearances, for the origin of which it is unable to give any satisfactory account. In this state of uncertainty, we find that variety of conjecture as to its origin which must always arise when we are groping our way in the dark. Some have been disposed to seek for it in the nature of the soil, and the mode of cropping to which it has been subjected; others in the kind of manure used, and the manner in which it has been applied; others have had recourse to the weather and other atmospheric influences, and not a few have supposed it to be produced by the attacks of insects. The latter of these opinions has of late, I believe, been gaining ground, partly perhaps from the failure

* This Report was written in August 1858.

of every other attempted explanation; and it must be admitted, on the most cursory view of the subject, to receive countenance from what is observed in other vegetables placed under somewhat similar conditions.

Having long been accustomed to attend to the economy and operations of insects, and having directed particular attention to the phytophagous species, or those that feed on plants, especially such as thereby prove injurious to our cultivated crops, it occurred to me that I might possibly render some service to agriculture by subjecting the disease in question to a careful examination, with the view of determining whether it had any connection with the attacks of insects, and especially if it could be traced to these as its cause. To this I was further induced by the representations of several eminent agriculturists, who thought that I might succeed in throwing some light on the subject by taking it up in this point of view. In common with some of these agriculturists, and especially the most eminent of them, who favoured me with a full statement of his opinions,* I was rather disinclined, previous to particular examination, to favour the insect theory, and more disposed to look for an explanation in some other direction. Yet, even with this impression, I thought that it would be of advantage to enter upon the inquiry, and that something would be gained even by proving, if the evidence was found to justify such a conclusion, that the disease did *not* proceed from insects. By establishing this point, the investigations of future observers would be facilitated by the field of research being narrowed, and a successful result rendered more easily attainable. The conclusion, therefore, at which I have arrived—namely, that the disease *is* of insect origin—is different from what I at first anticipated.

Estimating the difficulty of the subject by the numerous failures in previous attempts to illustrate it, I thought that I could not better prepare myself for the direct examination of the turnip disease, than by observing whether anything of a similar kind was to be found in the plants belonging to the same natural family which are most closely related to it. By noticing what insects feed on these, the nature of their attacks, and the consequences that resulted from them, I thought it likely that I might gain an acquaintance with analogous facts which would help to guide my future inquiries, and throw no inconsiderable light on the whole subject. A short reference to these, along with a few preliminary remarks of a general nature, will render what follows more readily and fully understood.

One of the great uses of plants, in the economy of nature, being the support of animal life, we find, as might be expected, that a very large number of the almost countless tribes of insects live in and upon them, and derive from them their whole nourishment.

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* Henry Stephens, Esq., author of the *Book of the Farm*, &c.

There is, indeed, no part of a plant, or of its produce, which is not liable, in some way or other, to be laid under contribution for the comfort and accommodation of this almost ubiquitous class of animals. But they by no means feed on plants indiscriminately; particular tribes are not only appropriated to particular parts of plants, but they select individual species to which, for the most part, they exclusively confine themselves. So strictly is this the case, that the majority of plant-feeding insects would perish, even when surrounded with vegetation, if their appropriate vegetable food happened to be inaccessible. There is some relaxation of this rule in the case of plants composing a very natural genus or family, in which, from the qualities being necessarily so much alike, we find the same insects ranging over a considerable number of them, and seemingly equally at home in all. And if this be the case with regard to different *species* of plants, we may expect to find it still more strongly exemplified in respect to the different *varieties* of the same species; these, accordingly, are all liable to the attacks of the same kinds of insects, although they may frequently show a preference for one variety rather than another.

The Cruciferous family of plants, one of the most natural, and, viewed in relation to this country, one of the most numerous, supports a great variety of insects; and of this family, the Brassicaceous species—that is, the cabbage and its allies—have a more than ordinary proportion assigned to them. This is probably owing to their expansive and succulent foliage, more especially in a cultivated state, their large stems, and sometimes remarkably developed fleshy roots. Of the insects that feed on the foliage of the genus Brassica, and its different species and varieties, it is unnecessary to say anything in this place; but it is of some consequence to bestow a brief consideration on the kinds that inhabit the stems and roots, as by so doing some light may be thrown on the peculiar affection of the roots of the closely-related turnip, to which it is the object of the present notice to direct particular attention.

A few words may be premised respecting the botanical relations of the genus *Brassica*, its species and varieties. The common cabbage (*B. oleracea*) is a species, and the equally familiar inmates of our gardens, savoy, cauliflower, greens, &c., are varieties of it. *B. campestris* (Wild Navew) has given origin to the Swedish turnip and its numerous varieties; while *B. Rapæ* is the parent stock of the common turnip. Hybrids in great variety have been produced by the blending of these two supposed species. But there is great reason to believe that both of them, as well as *B. napus*, (rape or colewort), are mere varieties of each other, pushed into the abnormal and sufficiently diverse forms they now present by cultivation and other artificial influences. These sufficiently familiar facts are recounted, in the present instance, for the purpose of showing the closeness of relationship, not only between the two last reputed species, but also between them and *B. oleracea*. All of

them, therefore, obviously come within the conditions above referred to as necessary to render them, indiscriminately or nearly so, the common food of the same insects. Of this we have a conspicuous instance in the caterpillar of the white cabbage butterfly, which, though it prefers the plant from which it derives its name, is frequently found on the leaves of the different kinds of turnip. The black caterpillar of *Athalia spinarum*, though most partial to the turnip, frequently infests congenerous Cruciferæ; and the small beetles, *Haltica nemorum* and *H. concinna*, bestow their attentions on the seed-leaves of many different species in a very impartial manner.

The underground stems and rootlets of the cabbage and its varieties are the habitual residence of several kinds of small weevils of the genera *Nedyus* and *Ceutorhynchus*. These insects are very minute, sometimes under a line and seldom exceeding a line and a half in length; the body short, thick, and prominent at the shoulders, and the head prolonged anteriorly (as in other weevils) into a long narrow beak or snout. When disturbed, the insect draws its snout and legs towards the body, packing them up as closely as possible, when it drops to the ground and lies as if dead, a state in which it bears considerable resemblance to a small black seed. I examined with great care the proceedings of one of the species, which appeared in abundance on the stalks of the common green, last spring. The eggs are laid on the cuticle of the plant, either partially inserted by a hole being bored for their reception, or made to adhere to it by some secretion deposited along with them. However this may be, a change speedily takes place in the surrounding portions of the plant. The cuticle swells outwards, and a blistered spot soon forms, the centre of which is occupied by the larva. This growth rapidly advances till a large wart, or tubercular swelling, is formed, completely enclosing the larva, which finds sufficient food by gnawing the substance which forms the sides of its cell. These grubs were full grown in April, when they gnawed a round hole, the exact size of the body, in the walls of the excrescence, and dropt into the earth, where they underwent the pupal change, and the full-grown insect made its appearance in a few weeks. These larvæ, or grubs, like all those destined to live in the interior of vegetables, and removed from the influence of light, are colourless, clear, and almost translucent; the body wrinkled transversely, and the head, which is rounded-oval and of a light-brown colour, furnished with two dark-brown mandibles dentate at the tip. It is without legs, change of place being effected by the vermicular motions of the segments, which are supplied with small eminences to catch the inequalities of the surface along which it crawls. The perfect insect proved to be the *Ceutorhynchus sulcicollis* of systematic writers.

The history of this insect is thus particularly adverted to, that it may be easily identified by other observers, and an opportunity

thus obtained for observing the effect produced by the operations of the larvæ or grubs on the growth and condition of the plant. When the swellings containing the larva were numerous on the same stem (which was frequently the case in those I examined), they often became confluent, and the stem assumed a very knobbed and contorted appearance. The substance of the stem became remarkably hard and woody, as if its juices had been partially subtracted, and diverted from their original purpose, the rootlets twisted and distorted, and the whole growth of the roots irregular and abnormal. This is the state which is sometimes called *clubbing*, although that term is used very vaguely, and is sometimes applied to an affection of the root produced by other agents. It is not confined to any particular variety of the cabbage tribe, but occurs occasionally in all. This autumn I observed what seemed to be the larva of the same species (as it appeared identical, I thought it unnecessary to rear it to the perfect state) on the bulbs of the turnip. Protuberances were formed about the size of a hazel-nut, and these were scattered over the surface, and occasionally clustered together into knobbed excrescences. Their disturbing influence on the growth of the plant appeared to be quite partial and local, being confined to the vicinity of the surface; and they bore so small a proportion to the size of the bulb, that its general health seemed in no degree interfered with. It is otherwise, however, when a colony of these creatures settles on the root of a plant of small dimensions. *Nedyus contractus* and *N. assimilis* frequent the roots of the wild mustard *(Sinapis arvensis)* and wild radish *(Raphanus raphanistrum)*. Last summer I found specimens of the last-mentioned plant in which the roots were entirely occupied by *N assimilis* The roots were so knobbed and distorted that they were raised above the ground; the whole substance had become implicated in the excrescences produced by the larvæ, and the tops of the stems were withering for want of nourishment.

These particulars are referred to for the purpose of showing that the roots of this family of plants—the family to which the turnip belongs—are particularly subject to the attacks of insects, and that these are very liable to result in tumours and tubercular excrescences. They demonstrate the fact—a very important one in this inquiry—that the puncture or bite of these insects is not merely a simple laceration, or mechanical division of the parts. By means which we cannot explain (it may be by emitting some fluid secretion of their own, or by rupturing the circulating vessels, and thereby allowing the extravasated juices to mingle, and thus become changed in their chemical composition), they have the power of originating a new action in the plant, and developing an extraneous growth in a direction and form which are not natural to it. And if this be the case when the insect is confined to one spot, as in the instances already spoken of, how much more likely is it that more considerable consequences of the same nature will ensue, when the

insect has the power of operating on any part of the root, and traversing it in all directions?

And this is the case with an insect of another kind, of which we shall afterwards have occasion to give a particular account. The stalks and roots of the cabbage and its varieties are likewise infested by dipterous larvæ, or the maggots of flies, often to such an extent as to cause the failure of the crop. The most formidable of these depredators, both in this country and on the Continent, is the maggot of *Anthomyia brassicæ*, although others are occasionally associated with it. This maggot traverses the cuticle in all directions, forming winding paths upon it, occasionally penetrating inwards, and inducing putrefaction on all sides of its track. Not unfrequently one of them takes its station in the centre of the pith towards the extremity of the root, and mines perpendicularly. These proceedings have an obvious effect on the fibrils of the root; they become stunted, often changed in the direction of their growth, and seem to become incapable of taking in nourishment from the soil I have frequently also seen the fibrils swollen into tubercles, although not of large size, sometimes without any maggot being visible upon them, at other times bearing externally the marks of its tracks; and on one occasion I found the maggot itself imbedded in the substance of one of these swellings. They seemed quite analogous to the swellings on the roots of the turnip when the finger-and-toe disease is in its incipient stage, although the very different condition of the cabbage-plant from that of the turnip, prevents them assuming the remarkable appearance they present in the latter. These attacks, however, frequently prove fatal; and the German naturalist Bouché informs us that entire fields of the plant are sometimes destroyed by them.

I made many other observations on the Brassicaceous plants, with a view to familiarise myself with the insect-attacks to which they are liable, and the appearances they present under them, that I might be in a condition to apply the knowledge thus acquired to the examination of the turnip, and make comparisons between them when circumstances required. These observations it is unnecessary further to particularise. But they could not fail to result in the conviction that, the roots and bulb of the turnip were extremely likely to be assailed by insects, and that the effect would probably be some form of tubercular swelling; otherwise they would form a singular and anomalous exception to the general lot of their tribe.

On transferring my attention to the turnip, I had the advantage of access to a small field quite adjoining my place of residence, and which was most suitable for my purpose, as it had always been remarkable for the prevalence of the disease. On examining it on the 20th of July (1858), shortly after the turnips had been thinned, I found that it had made its appearance in a very decided form. On

inspecting the diseased plants, as well as some others in which it had not yet developed itself, I had no difficulty in detecting a small dipterous larva, or maggot, actively at work. It was found most frequently at the lower extremity of the tapering root, either in the cuticle or in the centre, and for the most part mining its way upwards. In other instances it had entered the side of the root higher up, and penetrated to the centre; while in other cases, after doing this, it had penetrated upwards and downwards, throughout the whole substance of the incipient bulb; no part seemed exempted from its visits, although it seemed to prefer the lower portions. I occasionally, also, observed it in the fibrils of the root, though there it occurs but seldom, as they scarcely afford sufficient volume for its operations. Devious paths were frequently observable on the exterior cuticle; and its track could in most cases be traced without difficulty by the rust-coloured stains it imparts to the flesh of the turnip. I carried several of these maggots home with me, for the purpose of rearing them till they produced the fly. In order to determine, in the first instance, whether the turnip was their appropriate food, or whether they might be frequenting it in an accidental manner, I placed some of them under a small bell-glass, along with a slice of turnip, potato, carrot, and mangold-wurzel. Next morning I found them all collected on the slice of turnip, and some of them had completely imbedded themselves in it, as they all ultimately did, affording the clearest proof, of what indeed I had little doubt, that the turnip was their natural food.

On subsequent visits to the same field, which I made for a length of time almost daily, I never failed to observe the same maggot, attended with the same appearances, occasionally under slightly modified forms. Other insects were at times noticed, especially where the bulbs began to show symptoms of decay; but no other particular species was uniformly or even generally present, and their appearance was evidently accidental, being just such a miscellaneous assemblage as is usually attracted by decaying vegetable substances. Once only I found the caterpillar of a saw-fly mining into the heart of a healthy turnip; and the superficial tubercles of the *Nedyi* and *Ceutorhynchi*, formerly alluded to, were occasionally met with. These stray visitors consisted for the most part of small Staphylinidæ, wireworms, the subterranean caterpillars of certain moths, podurae, and, above all, several kinds of Juli and *Polydesmus complanatus*. They may hasten the progress of the putrescence among which they riot, but they have evidently no connection with it as its original cause. Indeed the roots of the turnip, while in a healthy state, do not appear to be much infested by insects; the dipterous larva in question seems to me to be almost the only one, at least in Scotland, that attacks them habitually and produces serious effects.

The fly appears to lay its eggs on the turnip-plant while the

latter is still very young. If deposited, as appears to be the case, on the crown of the plant, or exposed upper portion, the maggots, at an early stage, work their way downwards. I found that the soil forms no impediment to their progress, for though their bodies seem so soft, they can readily bury themselves to some depth in the earth. When I first examined them, on the 20th July, they were of various sizes, some of them very young, and others pretty well grown, although none appeared to have reached their full dimensions. The white turnip and the swede were equally affected: the former sooner showed symptoms of weakness under the attack, the growth becoming altered, the outer leaves flaccid and withering, the inner ones at first drawn up, somewhat rigid, and darker in colour, but ultimately drooping like the others. The swede struggles to the last, under the severest attacks, and retains some degree of vitality even when the root may be supposed to have nearly lost its functions; from which it may be inferred, that it must derive much of its sustenance from the atmosphere. Though the extremity of the tap-root seems to be the favourite point of attack, no part of the root, as formerly intimated, is exempted; and it is no uncommon thing to find pretty large bulbs pierced to the centre, or even through and through. From the detailed description afterwards given, it will be seen how well adapted the maggot is, by its form and structure, for this mode of life. Its sharp and pointed mandibles work with great rapidity; the conical shape of the anterior part of the body fits it for penetrating, wedge-like, into the opening thus made; the hinder extremity, which is the widest part of the body, truncated and furnished with spiracles, serves to keep the hole open, and give access to air from without. It is probable that the air admitted in this way, coming in contact with the newly-lacerated flesh of the turnip, may help to produce the ferruginous or rust-like appearance which marks the insect's track, although that, I conceive, is mainly owing to another cause, afterwards to be noticed.

I made an extensive examination of the turnip crop of this season in Roxburghshire, where it is well known to be cultivated on a large scale; and wherever I found the finger-and-toe, I also met with the maggot in question, provided I made the examination at the proper time. For it is important to observe, that as, on the one hand, we may have the insect without the disease, so, on the other, we may find the disease without the insect. In other words, we may examine the plants at so early a period that the attacks of the insects may not have produced, in any perceptible degree, the effects which I cannot help assigning to them, and we may be so late that the insect has disappeared. For after feeding some time, perhaps for three weeks or upwards, the maggot attains its full growth, and prepares to undergo the next change in its metamorphosis. This it does by leaving the plant, penetrating into the

soil, and there becoming changed into a pupa. It thus happens that the time when the disease is in its state of greatest development, is just the time when we are least likely to find the insect. It is partly this circumstance, I am inclined to think, that has led so many to deny that there is any connection between the disease and insects, because, on examination, they have found no trace of insect life beyond what might be expected in any putrescent substance. But in the very earliest stages of the disease, I have never failed to detect insect agency, in all parts of the county above mentioned that I have had an opportunity of visiting. The same maggot, I have ascertained, infests the crop in Berwickshire, Peeblesshire, East Lothian, Aberdeenshire, &c.; and I know that it likewise occurs in England and Ireland.

In these circumstances I could not fail, even at an early period of my observations, to connect the insect in question with the disease, as cause and effect. The evidence seems to warrant, or rather to compel to, this conclusion. Whatever I had previously observed in the proceedings of noxious insects, went to convince me that this explanation accounted for all the phenomena of the disease, considering that some of its peculiar features are no doubt to be ascribed to the peculiar condition of the plant in which it manifests itself. The conviction of this in my own mind may, however, be stronger than my account may succeed in conveying to the minds of others, especially those (and they constitute the great majority) who have been unaccustomed to bestow any attention on the effects produced on plants by the attacks of insects. It was late in the season before I succeeded in rearing the perfect insect from the larva, and the experiments which might have been made with it could not therefore be undertaken in a satisfactory manner. The only direct experimental proof which I have to offer is the following; the other proofs are inferential, or founded on what takes place in analogous cases.

I selected two plots of turnips, in two separate localities, where the disease had never appeared on previous years, and where the plants were in the highest state of vigorous growth. The plants were still young, although perhaps somewhat further advanced than they usually are when first attacked. Having selected two plants from each plot, growing in the rows along with the rest, and marked them so as to be afterwards easily identified, I made two openings in the root of each, at some distance from the crown, and inserted a maggot in each opening. I continued to observe them till I saw them begin to penetrate inwards, when the roots were again covered up; and I waited for the result. In about a week or ten days, the health of the plants thus treated had become evidently affected; and before a much longer period had elapsed, they presented a different appearance from the untouched plants growing around them. The inner leaves had become rigid, and,

instead of bending outwards, were drawn towards each other, while the colour was much deeper than the natural hue; the outer leaves, at the same time, had become flaccid and withering. These symptoms, it is true, might arise from the operations of the larvæ, as they undoubtedly did, without it necessarily following that the peculiar disease in question was in the course of being produced. Still they show how much the general health of the plants was affected, and how decidedly a morbid influence had set in. When the roots were dug up, about a month afterwards, it was found that the bulbs had not expanded to above a third of the size of the adjoining ones, and all of them more or less showed some symptoms of the finger-and-toe. One of them had a large tubercular swelling on one side, and others of smaller size were scattered over the surface, while the texture had become hard and woody. In the others the symptoms were less strongly marked; but they were such, that those who saw them thought they recognised in them the presence of the disease. All the other plants in the two plots grew to a large size, and continued entirely free from the affection.

This little experiment I did not expect to be more conclusive than it proved. The plants, in both instances, grew in a deep garden-soil, richly manured; and they were in such vigorous growth that they might be expected to make the most effective efforts to throw off any noxious influence affecting them. The larvæ, too — a circumstance which was not adverted to at the time—were nearly or quite full-grown, and would not, on that account, be so active in their operations as in their earlier stages. They should, besides, have been placed at the extremity of the root, by injuring which the whole vegetative powers of the plant are most seriously deranged. I am, moreover, of opinion that the disease never assumes its most aggravated form, unless in places where the depredations of the insect are seconded, as it were, or rendered more detrimental, by certain peculiarities of soil and situation.

It is obvious that the erosions and perforations of the insect, even when considered simply as mechanical—that is, unattended with any chemical action or infectious influence—may affect the health, and even the life, of the plant. They rupture the tissues, interrupt the regular course of the sap, and allow it to escape from the vessels and become diffused, while, by admitting air and moisture into the interior, they may induce putrefaction; and more especially are they detrimental, when they injure or destroy the extremity of the tap-root, or the rootlets whose function it is to supply nourishment from the soil. It is quite possible that these injuries may be sufficient of themselves to cause the whole disease under consideration, and that we need have recourse to no other agency. I cannot help thinking, however, that there is something else to be taken into account, which gives such remarkable energy to the insect's

operations, and which combines with the mechanical injuries just mentioned in producing the results we witness. I think it extremely probable that the insect communicates some taint or infection to the plant. In a case where direct evidence cannot be supplied, let us see what considerations there are calculated to support this idea. This I must do very briefly.

Allusion has been already made to the effects produced on the turnip by the bite or punctures of certain small weevils or their larvæ. The parts swell; an extraneous growth commences; and the result is the formation of a pretty large tubercle, or aggregation of tubercles. Here, then, we have a distinct proof of more than mechanical action. Some fluid secretion, of a peculiar nature, is no doubt emitted by the insect, which induces this remarkable growth. Such is likewise the case, in a still more striking degree, with the family of the *Cynipsidæ*, or gall-flies, which produce monstrous excrescences, sometimes as large as an apple, and sometimes covered with leaf-like expansions of most singular form. In these cases, it is true, we can discern a distinct purpose to be served by the exercise of this remarkable power—namely the protection of the egg, and the larva that proceeds from it, from the attack of birds, and especially parasitic flies (*Ichneumonidæ*). In the present instance, it may be alleged, no such provision seems to be required, as the larva moves about throughout the substance of the turnip, which at once protects and feeds it. A few general considerations, however, will suffice to show how very probable it is that a similar power of acting upon the vegetable tissues, and causing their ultimate decomposition, has been conferred on the larva we are now considering.

We are too little acquainted with the habits of the perfect insect, the fly, to say whether it deposits any active fluid along with the eggs. Such may be necessary to insure their adhesion, and to prepare the food, by partial decomposition, for the larva when first hatched. We are not, however, in a condition to affirm that any immediate injury arises to the turnip from this cause. But that the larva possesses some active fluid to aid its operations, is rendered highly probable when we consider the part these agents are designed to act in the plan of nature. One of their functions is to remove dead, decaying, and superfluous vegetation; hence they are called the great *scavengers* of nature. For this purpose, none are more effective than the tribe to which the larva we are now considering belongs. Most of them, when handled, discharge from the mouth a small quantity of fluid, which is usually of a very pungent and caustic quality. Indeed, the secretions of this nature, in insects in general, are the most powerful and concentrated to be met with in any of the kingdoms of nature. Hence the remarkable smells many of them diffuse, sufficient, no doubt, to protect them, in most cases, from their natural enemies. The disappear-

ance of vegetable substances, under the operations of insects, which is often so rapid as to occasion surprise, is in all probability partly owing to the secretions they emit in their progress through them, which soften the tissues, facilitate decomposition, and bring on putrefaction much sooner than could be done by the unaided action of the atmosphere. *In fact, the salivary discharge which accompanies the act of manducation, may be quite sufficient to produce this effect.* The power, therefore, of employing this solvent and alterative principle seems necessary to enable them effectively to accomplish the purpose for which they are intended in the economy of nature. That some of our useful plants, as in the case of the turnip, become the subjects of their operations, is merely an illustration of the fact, so often exemplified, that partial evil may occasionally arise out of an arrangement calculated to produce general good.

On the supposition that the larva of the turnip possesses the property in question, it is more easy to conceive that such consequences should arise from its attacks as are seen in the appearances of the finger-and-toe disease By the perforations of the maggot the vessels and tissues must necessarily be broken up, the juices become extravasated and diffused ; and their natural mode of action being changed, they produce abnormal growth, in the form of radical excrescences, to which, as has been formerly explained, this family of plants is peculiarly prone. By further supposing that the juices are not only changed in their mode of action, but altered in quality by the infusion of some foreign substance, some active fluid, or what may be called, in reference to the plant, some poisonous principle, further abnormal growth may naturally be expected, as well as general disease, rapidly tending to gangrene and putrefaction. It will be easily understood, from these considerations, why the disease is so often seen in progress long after the insects, the supposed original cause of it, have disappeared. The evil was committed in the earlier stages of their attacks, the morbid influence communicated, and it continues to operate without their further agency. Protuberances and the other features of the malady may continue to be produced, and no insects present—a circumstance which must have led so many to suppose that they had no part in causing them.

In order to understand more fully how it happens that the effects are so marked and so fatal in the turnip, it is necessary to call to mind the peculiar condition in which that plant is now found. It is one of the most artificial of our cultivated vegetables, one on which the greatest ingenuity has been exerted to increase to the utmost its bulk and feeding qualities. It is one of those, therefore, furthest removed from a natural state ; and if there be a point at which the restraints of nature begin to put a check on the interference of man—if there be a physical law, as there no doubt is, applicable to vegetable development, as strict as that in regard to

the ocean, "Hitherto shalt thou come, but no further,"—the turnip may be said to have nearly approached that limit. Already its constitution is showing signs of debility; and in the aggravated inroads of old diseases, and the appearance of certain others from which it was formerly free, it may be regarded as putting up signals of distress. The unusual stimulus it has recently received from the use of guano has further increased this tendency, and may almost be said to have reduced it, like the undue use of alcohol in the human subject, to a state of hydropsy. We cannot say what the chemical composition of the turnip is in a wild or natural state, for it can scarcely be said to be known otherwise than as a cultivated plant; but 93 and 94 parts in the 100 of water, which it yields to modern analysis, is an enormous proportion. It is easy to understand that when a bulb so constituted is perforated and lacerated, and the superabundant juices allowed to escape from their natural canals, and collect in other parts, very great irregularities of growth must necessarily follow, and that any infectious matter, applied at any one spot, will find a ready vehicle for diffusing it throughout, and corrupting the whole system. Neither can it be regarded as any proof of the non-existence of such infectious matter, that chemical analysis has hitherto taken no notice of it; a portion too minute and subtle to be recognised by a much more delicate chemistry than can be now applied to it, would suffice for the effects produced.* Even in galls, chemists have detected no other principles than such as exist in the plants from which they spring; but surely the fluid deposited along with the eggs by the parent fly, or that emitted by the larva, must be different, and of a very peculiar nature, to act with such energy, and produce such remarkable consequences. Mere irritation will not account for the results; for in almost every species of insect the gall has a different character, even when occurring on the same plant.

These considerations, to which others might be added, will perhaps be considered sufficient to justify the belief that some taint is imparted by the insect to the plant. Should it be thought that we are not warranted in adopting this conclusion, then the insect, as the only ostensible cause of the disease, must be supposed to produce it by the mechanical injuries it inflicts, and the action of the atmosphere consequent upon them—circumstances perhaps fully adequate of themselves to account for the effects, in a plant in so peculiar a condition as the turnip now is.

Had the fly, the parent of the turnip larva, been obtained sufficiently early in the season, some experiments might have been tried with it, both for the purpose of procuring additional evidence as to

* A comparative chemical analysis of healthy turnips and those affected with this disease has been made, with all due care and skill, by Dr Anderson. The differences are not considerable, nor calculated to throw much light on the subject; indeed, I have seen greater disparities in different analyses of healthy plants. In investigations of this nature, chemistry is not yet in a condition to lend much aid.

its being the cause of the disease, and also determining what means were best calculated to arrest or put an end to its ravages. It might have been enclosed, for example, along with a growing turnip-plant, under a gauze covering, and its proceedings observed; the process of oviposition, the hatching of the larvæ, &c., would thus have been more accurately ascertained. These and other particulars I hope, on a future season, to be able to determine; for it is only by a perfect acquaintance with the history and habits of the insect that a remedy for its depredations is likely to be discovered. The consideration of such remedies as have already suggested themselves to me, it is not my present purpose to enter into; the sole object of this communication is to explain what I believe to be the cause of the disease. The disease itself I have thought it unnecessary to describe, as its peculiar characters are only too familiar to those who are likely to feel any interest in this notice. It only remains for me, therefore, to describe the insect to which the preceding remarks refer as the cause of this disease, in its different states and metamorphoses. But before doing so, a few remarks may be desirable on the explanation which this view of the origin of the disease affords of some circumstances which have been previously observed regarding its appearance and character; and if this explanation be regarded as satisfactory, it may be assumed as additional presumptive evidence that the view in question is correct.

It accounts for the irregular, and, if that term may be used, capricious appearance of the disease, which is very general in certain seasons, and comparatively local and restricted in others. This circumstance has always been characteristic of insect depredations; and even with the increased knowledge we have now gained of their economy, the cause of it is still very imperfectly understood. The fly of the carrot (*Psila rosæ*), for example, whose operations present many points of resemblance to those of the turnip maggot, is very destructive to that root in certain seasons, and comparatively innocuous in others, when circumstances are, to all appearance, nearly the same. The black turnip caterpillar of the saw-fly I have seen devastate fields at intervals of many years, not a single individual appearing in the intermediate seasons. No doubt the character of the seasons, in regard to the state of the weather, has the chief influence in causing this irregularity, but it seems insufficient fully to account for it.

This view of the origin of the disease accounts for the failure of the attempts which have been often made to check it by different modes of ploughing, cropping, &c., and also by the use of different kinds of manure. It is not to be supposed that these expedients can in general have any material effect on the proceedings of the insect. To this remark, however, there is one very notable exception. It is one of the very few well-determined facts regarding this affection, that its progress is arrested, and in some cases its

appearance seemingly altogether prevented, by the application of lime. Now this substance has been long known and extensively used—more perhaps than any other application—as a remedy or preventive for the attacks of insects; I have known it succeed when many other applications failed. It has by no means proved a specific, or uniform and infallible remedy, in the case of the turnip disease, but it has, in almost all cases, operated with more or less efficacy. Now this is precisely what might have been expected from our previous experience of its effects, on the idea that here also we have to deal with insect influence.

It is a well-ascertained fact that when diseased turnips are stored in a field intended for a turnip crop next season, or strewed on the surface to feed sheep or cattle under the same circumstances, the disease seldom fails to make its appearance in such spots in the ensuing crop. In such cases the simple explanation is, that some of the larvæ or pupæ have remained in the roots, whence they have reached the soil, and thus the perfect insect was ready on the spot to commence operations when the proper season arrived. It is not easy to see how the fact in question admits of any other explanation. That the soil should become infected in the ordinary sense of that word, by the diseased portions of the roots, and transmit the infection to the young plants, is a hypothesis wholly inadmissible.

It has been very generally observed that the disease is usually most prevalent along the head-riggs and sides of fields, and this has been supposed to be owing to these places being more trodden down by the cartage of manure, and the trampling of the horses in ploughing and harrowing: hence it has been inferred that the mechanical condition of the soil has influence on the disease. It appears to me to be simply owing to the fact, that such places are usually in the immediate vicinity of hedges, walls, and skirting plantations, which afford warmth and protection to the fly, especially against strong winds, with which it is ill fitted to struggle. In these spots also it finds places of refuge and concealment when it spends the winter in a dormant state.

Such explanations might be easily multiplied, but many of them will probably occur to those who have made this question the subject of their attention.

The insect to which the preceding observations refer, as producing the turnip maggot, is the *Anthomyia brassicæ*, previously alluded to as infesting the cabbage-plant. It was first described under that name by Bouché in his *Naturgeschute der Insekten*, p. 74, and is synonymous with the *A. Napobrassicæ* of Bjerkander, and *A. brassicæ* of Wiedemann. Under the first of these names it has likewise been described as a British insect by Mr Curtis and Mr James Hardy. By the former of these authors, it is figured in the *Journal of the Royal Agricultural Society of England*, vol. iv., Pl. H.

The larva, when full grown, is about 3 or 3½ lines in length. The body is cylindrical, but tapers towards the head, which is small, narrow, and pointed. The colour is a clear white, the surface smooth, shining, and without hairs. The mandibles are dark brown or black. The hinder segment of the body is truncated, somewhat obliquely, and slightly concave, furnished with ten short fleshy points or spinous projections, the lowest four placed in pairs. Towards the upper part of this terminal segment are two other projecting bodies of a yellowish-brown colour, which are the stigmata or breathing holes. It is without feet, the motions being effected by the movements of the segments, and it draws itself onwards by seizing on objects with its mandibles.

From the time of the larva being hatched till it be full grown, three or four weeks elapse. When fully matured it descends into the earth, and becomes changed into a pupa. This at least is the ordinary course; but in some which I kept in confinement, the turnip which contained them being placed on a thick layer of soil, they underwent this change occasionally in the excavations made by the larva, and of course continued there till their subsequent change; this may likewise happen at times in the fields. The puparium is reddish brown, sometimes inclining to yellow, ovate, and finely wrinkled across. Towards the head it is furnished with projecting stigmata; and the hinder segment, which is strongly cross-wrinkled, has ten knob-like projections, which are the fleshy points of the larva: the stigmata are likewise visible. The length is about 2 lines. This state continues for two, three, and even four weeks before the fly appears. In several which I have by me, they have continued in this state for six or eight weeks, and will not now disclose the fly till next spring.* All the larvæ that are late in undergoing this change, pass the winter as pupæ in the earth.

The fly presents considerable differences in the two sexes. In the *male* the general colour is ash-grey, and bristly; the head grey, the lower part, in front, white, with a brown play of colour, the sides reddish, the upper part silver-grey, changeable, with a red triangular mark on the crown; antennæ black, rather long, and bristled; the thorax ash-grey, with three broad black streaks having a play of colour; the sides whitish. The abdomen is narrow, linear, and cylindrical, lead-coloured, with a dorsal line and the incisures black; wings brownish; the scales yellow, and having long fringes. The legs are dark brown, or nearly black; the thighs with bristles on their external margin. Length about 2½ lines. In the *female* the head is clear grey, with a play of colour, and a broad, reddish-yellow streak on the forehead. The

* In the case alluded to, the insects continued throughout the winter and spring as pupæ, and the flies made their appearance in the beginning of last June; their appearance being thus quite coincident with that of the turnip crop.

black lines on the thorax are scarcely discernible in this sex. The wings are clear and hyaline, rather broad, and pale yellowish at the base; halteres yellowish. The legs are black, with a grey play of colour, and furnished with bristles; the tibiæ with three spines at the extremity. The abdomen narrow and slender, with an indistinct black line along the back; the bristles on the anterior segment standing upright, those on the others lying flat. The length nearly the same as in the male.

The flies frequently pass the winter concealed in the fissures of trees, and similar places. They make their appearance on the wing in June and July.

REPORT OF EXPERIMENTS CONDUCTED WITH A VIEW OF DETERMINING THE COMPARATIVE VALUE OF OTHER SUBSTANCES AS A SUBSTITUTE FOR GUANO.

By JOHN DOVE, Eccles-Newtown, Kelso.

[Premium—£20.]

FOR some years past, since the progressive rise in the price of guano commenced, I have been in the practice of trying a few experiments every season, to assist me in deciding what other manure I could most profitably use as a substitute for it, in raising the different crops grown on my farm; and as the Highland and Agricultural Society has offered a premium for a report upon this subject, I have endeavoured to carry out my experiments for the year 1857 as nearly as I could in compliance with the conditions required, and now submit my report of them for that season.

The manures I resolved to try against guano were nitrate of soda, sulphate of ammonia, superphosphate, and ground rape-cake. These I bought in the month of October 1856, before the last rise in the price of guano took place—the guano at £12, 10s. per ton, the nitrate and sulphate at £18, 10s., the superphosphate at £8, 10s., and the rape-cake at £6, 5s.; and in all the experiments I applied as nearly as possible the same money-value to each lot. The manures were bought with a guaranteed analysis, and tested and found to be unadulterated. As the quality of superphosphate varies so much, I give the analysis of the one I used; the other manures, when genuine, do not vary much.

ANALYSIS OF SUPERPHOSPHATE BY PROFESSOR ANDERSON.

Water,	18.20	Sulphate of Lime,	5.79
Organic Matter,	8.24	Sulphuric Acid,	19.57
Soluble Phosphates,	39.30	Alkaline Salts,	2.93
Insoluble do.,	1.64	Sand,	4.33

No very great reliance can be placed on the result of the experience of one season only; the character of the weather has a great effect upon the action of different manures, more particularly when applied as a top-dressing to the cereal crops; and the manures that may have had the most beneficial effect one

season, may with different weather, though otherwise applied under similar circumstances, show a very different result the next season. As, however, it would lengthen out this report too much to include all the experiments I have made in former seasons, several of which have already been published, I will merely mention, in my remarks on the experiments of 1857, whether they agree with or show a contrary result to my previous experience. It also increases the value of an experiment very much to have it repeated more than once the same season under similar circumstances. I have found that, however careful I may have been in conducting an experiment with regard to selecting land equal in quality and condition, previous cropping and manuring, and in watching that no mistake was made in carrying it out, anomalies will often occur that I cannot account for; if possible, therefore, it ought to be repeated, that we may be enabled to judge by the average result of several trials. This I have not been able to do with the experiments upon the cereal crops; it is almost impossible for one man to carry out correctly many of them in the same season. From the scarcity of labour in the time of harvest, and the uncertainty of our climate, it requires all his energy to get his crop secured in proper time and condition, and he has neither time personally to look after a great number of experiments, nor labour to spare to work them carefully: for it requires a considerable amount of additional labour to lead and thrash or stack separately a number of single acres or half acres; I have thus always thought it better to rest content with a few instances for the correctness of which I can vouch, than to attempt too much at once. It is different with regard to an experiment upon the turnip crop; there is a longer time at command for lifting it than for securing the corn crop, and labour is not then so difficult to procure; and should bad weather intervene at the time you had intended to lift and weigh an experiment, it does not spoil its value even though it should have to remain a month or two longer on the ground. My practice has been to test the different manures that I used each year upon nearly every field of turnips that I made, and then take the average results.

The experiments on the cereal crops were made upon half-acre lots each. I was particular in selecting land where both soil and subsoil were as uniform as possible, and on which there had been no difference in the cropping and manuring for several previous rotations, and on which I had observed the previous crop to be pretty uniform. In ascertaining the produce, I weighed the whole of each lot on a steelyard, as it was carted from the field, then thrashed each separately, measured and weighed the corn, and deducted the gross weight of the good and light corn from the first gross weight, which left the weight of the straw and chaff.

In ascertaining the produce of the turnip experiment, the whole of each lot, after being rooted and shawed, was also weighed on the steelyard.

EXPERIMENT I.—On Potato Oats. Sown 15th April; Manures all applied at the same time, except No. 6, which was applied on the 23d May. Cut 25th August; Thrashed 23d Sept.

Manures per Acre.	Cost of Manure per Acre.	Produce of Good Corn per Acre.	Weight per Bushel.	Price per Bushel.	Value of Good Corn per Acre.	Produce of Light Corn.	Weight per Bushel.	Price per Bushel.	Value of Light.	Produce of Straw and Chaff per Acre.	Price per Cwt.	Value of Straw and Chaff.	Total value of Crop per Acre.	Gain from Application.	Loss from Application.
	£ s. d.	bsh. lb.	lb.	s. d.	£ s. d.	bsh. lb.	lb.	s. d.	s. d.	cwt. qr.	s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
No. 1.—2 cwt. Guano and 2 cwt. Salt	1 7 6	64 0	42	3 4	10 13 4	4 24	39	2 6	11 6	44 3	1 6	3 7 1¼	14 11 11¼	2 15 5¼	..
" 2.—11 st. Nitrate of Soda and 2 cwt. Salt	1 8 0	56 0	42	3 4	9 6 8	1 30	39	2 6	4 6	39 3	1 6	2 19 7½	12 10 9½	0 13 9½	..
" 3.—4 cwt. Rape-Cake and 2 cwt. Salt	1 7 6	51 24	42½	3 5	8 16 0	2 18	39	2 6	6 3	35 2	1 6	2 13 3	11 15 6	..	0 1 0
" 4.—3 cwt. Superphosphate and 2 cwt. Salt	1 8 0	52 0	43	3 6	9 2 0	2 14	39	2 6	6 0	35 0	1 6	2 12 6	12 0 6	0 3 6	..
" 5. {½ cwt. Nitrate of Soda and 2 cwt. Salt; 1 cwt. Rape-Cake and 2 cwt. Salt; 1 cwt. Superphosphate and 2 cwt. Salt}	1 6 6	57 12	42½	3 5	9 15 6	2 0	39	2 6	5 0	39 1	1 6	2 18 10½	12 19 4½	1 3 10½	..
" 6.—11 st. Nitrate of Soda and 2 cwt. Salt	1 8 0	62 0	42	3 4	10 6 8	4 0	39	2 6	10 0	40 2	1 6	3 0 9	13 17 5	2 0 5	..
" 7.—Nothing	..	45 38	42½	3 5	7 16 9	2 0	39	2 6	5 0	31 2	1 6	2 7 3	10 9 0	..	..

EXPERIMENT II.—On Barley. Sown 25th April; Manures all applied at the same time, except No. 7, one-third of which was applied at same time, one-third on 21st May, and one-third on 8th June. Cut 7th Sept.; Thrashed 22d Sept.

Manures per Acre.	Cost of Manure per Acre.	Produce of Good Corn per Acre.	Weight per Bushel.	Price per Bushel.	Value of Good Corn per Acre.	Produce of Light Corn.	Weight per Bushel.	Price per Bushel.	Value of Light.	Produce of Straw and Chaff per Acre.	Price per Cwt.	Value of Straw and Chaff.	Total value of Crop per Acre.	Gain from Application.	Loss from Application.
	£ s. d.	bsh. lb.	lb.	s. d.	£ s. d.	bsh. lb.	lb.	s. d.	s. d.	cwt. qr.	s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
No. 1.—2 cwt. Guano and 2 cwt. Salt	1 7 6	44 16	50	3 7	7 18 10	2 28	47	2 6	6 8	32 0	1 3	2 0 0	10 5 6	0 1 7¼	..
" 2.—11 stone Nitrate of Soda and 2 cwt. Salt	1 8 0	40 40	51	3 8	7 8 5	1 6	47	2 6	2 10	33 3	1 3	2 2 2¼	9 13 5¼	..	0 10 11¼
" 3.—11 stone Sulph. of Ammonia and 2 cwt. Salt	1 8 0	41 5	51	3 8	7 10 8	1 18	47	2 6	3 8	34 3	1 3	2 3 5¼	9 17 9¼	..	0 6 1¼
" 4.—3 cwt. Superphosphate and 2 cwt. Salt	1 8 0	34 20	52	3 9	6 9 0	2 4	47	2 6	5 3	28 1	1 3	1 15 3¾	8 9 6¾	..	1 14 10
" 5.—4 cwt. Rape-Cake and 2 cwt. Salt	1 7 6	34 36	51	3 8	6 7 2	2 16	47	2 6	6 0	28 1	1 3	1 15 3¾	8 8 5¾	..	1 15 3
" 6. {2¾ stone Nitrate of Soda and 2 cwt. Salt; 2¾ st. Sulph. of Ammonia and 2 cwt. Salt; 6 stone Superphosphate and 2 cwt. Salt; 1 cwt. Rape-Cake and 2 cwt. Salt}	1 7 0	40 40	50	3 7	7 6 0	2 0	47	2 6	5 0	27 3	1 3	1 14 8¼	9 5 8¼	..	0 17 8¼
" 7.—7 cwt. Saltpetre Salt	1 6 3	33 30	50	3 7	6 0 5	1 30	47	2 6	3 4	30 9	1 3	1 17 6	8 1 3	..	2 1 4¾
" 8.—Nothing	..	36 30	51	3 8	6 14 3	1 10	47	2 6	3 1	31 1	1 3	1 19 0¾	8 16 4¾	..	..

EXPERIMENT III.—On Red-Strawed Wheat. Manures applied on 1st May, except No. 7, half of which applied on 27th May. Cut 26th Aug.; Thrashed 24th Sept.

Manures per Acre.	Cost of Manure per Acre.	Produce of Good Corn p Acre.	Weight per Bushel.	Price per Bushel.	Value of Good Corn per Acre.	Produce of Light Corn.	Weight per Bushel.	Price per Bushel.	Value of Light Corn.	Produce of Straw and Chaff per Acre.	Price per Cwt.	Value of Straw and Chaff.	Total Value of Crop per Acre.	Gain from Application.	Loss from Application.
	£ s. d.	bsh. lb	lb.	s. d	£ s. d.	bsh. lb.	lb.	s. d.	s. d.	cwt. qrs.	s. d.	£ s. d.	£ s. d.	£ s. d	£ s. d.
No. 1.—2 cwt. Guano and 2 cwt. Salt	1 7 6	30 0	56	5 5	8 2 6	1 0	43	4 0	4 0	37 0	1 3	2 6 3	10 12 9	..	0 4 6½
" 2.—11 st. Nitrate of Soda and 2 cwt. Salt	1 8 0	32 0	57	5 7	8 18 0	0 34	43	4 0	3 3	39 2	1 3	2 9 4½	11 11 3½	0 13 0	..
" 3.—11 st. Sul. of Ammonia and 2 cwt. Salt	1 8 0	33 27	57½	5 8	9 9 11	1 1	43	4 0	4 0	42 2	1 3	2 13 1½	12 7 0½	1 9 3	..
" 4.—3 cwt. Superphosphate and 2 cwt. Salt	1 8 0	26 25	57½	5 8	7 10 0	0 38	43	4 0	3 6	29 0	1 3	1 16 3	9 9 9	..	1 8 0½
" 5.—4 cwt. Rape-Cake and 2 cwt. Salt	1 7 6	28 0	57½	5 8	7 18 8	1 13	43	4 0	5 0	30 0	1 3	1 17 6	10 1 2	..	0 6 0½
" 6. 2½ st. Nitrate of Soda and 2 cwt. Salt 2½ st. Sul. of Ammonia and 2 cwt. Salt 6 st. Superphosphate and 2 cwt. Salt 1 cwt. Rape-Cake and 2 cwt. Salt	1 7 2	29 15	57	5 7	8 3 4	1 5	43	4 0	4 6	35 2	1 3	2 4 4½	10 12 2	..	0 4 9
" 7.—4 cwt. Saltpetre Salt	1 6 3	30 0	57½	5 8	8 10 0	0 33	43	4 0	3 2	29 1	1 3	1 16 6¾	10 9 8¾	..	0 6 3¾
" 8.—Nothing	..	26 41	57½	5 8	7 11 8	0 40	43	4 0	3 9	27 2	1 3	1 14 4½	9 9 9½	..	..

EXPERIMENT IV.—On Beans. Manures applied 30th May; scuffled and hoed in on the same day. Cut 5th Sept.; Thrashed 5th Nov.

Manures per Acre.	Cost of Manure per Acre.	Produce of Good Corn per Acre.	Weight per Bushel.	Price per Bushel.	Value of Good Corn per Acre.	Produce of Straw and Chaff per Acre.	Price per Cwt.	Value of Straw and Chaff per Acre	Total Value of Crop per Acre.	Gain from Application.	Loss from Application.
	£ s. d.	bsh. lb.	lb.	s. d	£ s. d.	cwt. qrs.	s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
No. 1.—2 cwt. Guano	1 5 0	32 56	59	4 4	7 2 9	19 3	2 6	2 9 4½	9 12 1½	0 7 9	..
" 2.—5 cwt. Sulphate of Soda	1 5 0	27 48	58¼	4 4	6 0 8	19 1	2 6	2 8 1½	8 8 9½	..	0 15 7
" 3.—3 cwt. Sulphate of Potash	1 4 0	26 20	58¼	4 4	5 14 2	19 0	2 6	2 7 6	8 1 8	..	1 1 8½
" 4.—4 cwt. Rape-Cake	1 5 0	31 4	56¼	4 4	6 14 8	19 3	2 6	2 9 4½	9 4 0½	..	0 0 4
" 5.—3 cwt. Superphosphate	1 5 6	31 30	58¼	4 4	6 16 6	21 2	2 6	2 13 9	9 10 3	0 5 4½	..
" 6.—11 stones Sulphate of Ammonia	1 5 0	29 10	58¼	4 4	6 6 5	21 0	2 6	2 12 6	8 18 11	..	0 5 5½
" 7.—Nothing	..	25 22	58¼	4 4	5 10 0	19 3	2 6	2 9 4½	7 19 4½	..	..

Remarks on Experiment I.—This experiment was made on the farm of Eccles-Newtown, on a piece of free clay soil on an open subsoil, furrow-drained at 30 feet intervals, and in fair cultivation, though it had not had lime applied to it for eighteen years past. Previous cropping—1856, Italian rye-grass and red clover mixed, top-dressed with 1 cwt. nitrate of soda and 1 cwt. guano per acre, and cut twice for soiling cattle; a good crop, the rye-grass and clover pretty equally mixed; another part of the field was made into hay, and produced 250 stone per acre; 1855, wheat; 1854, Swedish turnips, manured with 18 loads dung and 3 cwt. guano per acre, and all carted off; 1853, oats; 1852, pasture. The manures were all harrowed in with the seed except No. 6, which was applied on a wet day after the oats were brairded; it was very favourable weather for top-dressing, continuing showery for three weeks after, with occasional pretty heavy falls of rain. The lots were all cut on one day; they were all nearly equally well ripened; Nos. 1 and 6 rather greenish. We had ten days very bad weather after they were cut, from which all the crop suffered very much: it was considerably sprouted, and there was also a loss from shedding, but all the lots would suffer pretty equally in both respects: they were allowed to stand till they got into very good condition, and thrashed off the stook and sold.

Here it will be observed that guano is the most profitable application; this agrees with my previous experience. I have never found any other manure so certain in its effects upon oats, and I have rarely ever applied it without a profitable result; but it will also be observed that nitrate of soda, when applied as a top-dressing, is not much behind it. Nitrate of soda is too soluble to be applied at the time the seed is sown; as it acts so quickly, it is better to apply it when the plant is growing. But there is one circumstance that may be noticed here: from the time the crop was sown till the day that No. 6 was top-dressed, there was almost no rain; the land was never wet above an inch deep; so the first application of nitrate of soda could not have been washed away—it rather looks as if the loss had been from evaporation. Rape-cake and superphosphate are both comparative failures here. The conclusion I draw from this experiment is, that nitrate of soda, if judiciously applied, will prove as economical a manure for oats as guano, at the relative price of the two this season.

Remarks on Experiment II.—This experiment was made on the farm of Eccles, on a piece of free clay soil, on an open subsoil, furrow-drained at 30 feet; it had not had lime applied to it for more than twenty-five years. Previous cropping — 1856, Swedish turnip, manured with 15 loads dung and 3 cwt. guano and superphosphate per acre, and all carted off; 1855, oats, top-dressed with 2 cwt. guano per acre; 1854, pasture. This experiment also suffered very much in quality from the bad weather.

Here it will again be observed that guano leaves decidedly the best result; but it was a mistake applying the nitrate and sulphate so early. The experiment on the oats shows that they have a better effect when applied after the crop is brairded. It will be noticed that three of the manures caused a decrease in the produce. I can suppose that so large a quantity as 7 cwt. per acre of any saline manure might prove injurious to the crop in a dry summer like the last, but I cannot see how the small quantity of superphosphate and rape could do any injury; I rather think there is something anomalous here. This is the first exact experiment that I have carried out regarding the application of manures directly to the barley crop.

Remarks on Experiment III.—This experiment was made on a piece of strong clay soil on Eccles-Newtown farm, furrow-drained at 20 feet wide. The wheat was sown on November 18th. Previous cropping—1856, beans; 1855, wheat; 1854, yellow turnip, sown early, and one-half carted off, the other eaten on the ground in the month of October; 1853, oats. This crop under experiment was also exposed to the bad weather, and suffered greatly in quality: part that was secured before the weather broke weighed 62 lb. per bushel.

Here it will be observed that sulphate of ammonia is very much superior to any of the other manures used. This is in accordance with all my previous experience: in every trial I have made it has been the most profitable application. It has not the same tendency to cause the wheat to lodge as guano and nitrate of soda have, and the produce is invariably more weight per bushel. In this experiment none of the lots were laid—all stood well up till cut; but in previous ones I have noticed that if any of the lots were laid, the guano and nitrate of soda ones were always first down. The lots dressed with sulphate of ammonia did not get so much down, even though the increased weight of straw per acre was as much on them as on the others. As it has the effect of stiffening the straw, it is much the safest application, as there is always a loss when wheat goes down in a moist, growthy season. The superphosphate has no effect, and the rape-cake little. I believe that, to have had a fair trial, they should have been applied earlier, being comparatively slow in their action. I have always found rape a good manure for wheat, when applied in the autumn; but I had never before this tried it in the spring.

Remarks on Experiment IV.—This experiment was made on the farm of Eccles, on a piece of clay soil naturally very wet, but easily drained, having a free open subsoil, drained at 30 feet. Previous cropping—1856, oats; 1855, hay, top-dressed with 1 cwt. nitrate of soda and 1 cwt. guano per acre; 1854, wheat; 1853, Swedish turnip. The beans were sown on the 5th of March with

a machine, in 26-inch drills, and horse and hand hoed twice. The manures were applied at the time of the first hoeing. The whole field was rather a short crop of straw.

Throughout the season I never could observe any difference in the appearance of the different lots; and when they were cut, I thought none of the manures had had much effect, but both the guano and superphosphate show a very good result. The experiments on the wheat, barley, and oats were thrashed off the stook, but the beans were not in condition, so they were stacked. They were still rather soft when thrashed, and the difference in the weight of the lots may be caused by the various states as to dryness produced by the position they occupied in the stacks.

This is the first time I ever applied any manures as a top-dressing to beans, so I was rather at a loss what kinds to try. I had seen sulphate of soda recommended for the leguminous crop, but both it and the potash are failures. Guano is the best. Superphosphate and sulphate of ammonia do pretty well; they give the largest increase of straw. If they had been tried combined, they would perhaps have had even a better result.

EXPERIMENT V.—On GRASS. Manures all applied on 13th May, except Nos. 2, 4, and 6, one part of which was applied then, the second part on 27th May, and the third on 3d June. Cut 7th July; Weighed 3d August.

No	Manure per Acre.	Cost of Manure per Acre.	Produce of Hay per Acre.	Price per Ton.	Total Value per Acre	Gain.	Loss.	Weight of Second Crop per Acre
		L. s. D.	tn. cwt. qr.	L. s. D.	L. s. D.	L. s. D.	L. s. D.	ton. cwt. qrs.
1.	3 cwt. Guano, ...	1 17 6	2 0 0	3 10 0	7 0 0	0 18 6	..	3 11 0
2.	Do. do. . .	1 17 6	1 15 2		6 4 3	0 2 9	..	3 14 0
3.	2 cwt. Nitrate of Soda, .	1 17 0	1 17 0	..	6 9 6	0 8 6	.	3 14 0
4.	Do. do. .	1 17 0	1 19 0	..	6 16 6	0 15 6	..	3 13 0
5.	2 cwt. Sulph. of Ammonia,	1 17 0	1 16 2	..	6 7 9	0 6 9		3 12 2
6.	9 cwt. Saltpetre Salt, . .	1 13 9	1 8 2	..	4 19 9	.	0 18 0	3 14 0
7.	6 st. Nitrate of Soda, 6 st. Sulp. of Ammonia, 3 cwt. Saltpetre Salt,	1 18 0	1 16 2	..	6 7 9	0 6 9	..	3 8 0
8.	Nothing, ...	..	1 4 0	..	4 4 0	..	.	3 13 0

EXPERIMENT VI.—On GRASS. Manures all applied on 13th May, except Nos. 2, 4, and 6, one part of which was applied then, the second part on 27th May, and the third on 3d June. Cut 2d June; Weighed 4th August.

No.	Manure per Acre.	Cost of Manure per Acre.	Produce of Hay per Acre.	Price per Ton.	Total Value per Acre.	Gain.	Loss.
		L. s. D.	ton. cwt. qr	L. s. D.	L. s. D.	L. s. D.	L. s. D.
1	3 cwt. Guano, ...	1 17 6	2 1 1	3 10 0	7 4 9	0 2 3	..
2.	Do. do.	1 17 6	2 0 2	..	7 1 6	..	0 1 0
3.	2 cwt. Nitrate of Soda, ...	1 17 0	1 18 1	..	6 13 9	..	0 8 3
4.	Do. do.	1 17 0	2 1 1	..	7 4 9	0 2 3	..
5.	2 cwt. Sulphate of Ammonia, .	1 17 0	2 0 2	..	7 1 6	..	0 1 0
6.	9 cwt. Salpetre Salt, ...	1 13 9	1 10 0	..	5 5 0	..	1 13 9
7.	6 st. Nitrate of Soda, ... 6 st. Sulphate of Ammonia, 3 cwt. Saltpetre Salt, ...	1 18 0	2 1 1	..	7 4 9	0 1 9	..
8.	Nothing, ...	..	1 10 0	..	5 5 0	..	..

Remarks on Nos. V. and VI.—No. V. was made on the farm of Eccles-Newtown, on a clay soil with an open subsoil, furrow-drained at 20 feet wide, and limed twenty-one years ago. Previous cropping—1856, spring-wheat; 1855, Swedish turnip, made with 20 loads dung applied in the autumn, and 3 cwt. guano and superphosphate per acre, and all carried off; 1854, wheat; 1853, beans; 1852, oats. No. VI. was made on the farm of Eccles, on a piece of black loam on an open clay subsoil, furrow-drained at 30 feet wide, and limed with 7 tons quicklime per acre in 1856 before the barley crop was sown. Previous cropping—1856, barley; 1855, Swedish turnip (a third part eaten on the ground with sheep); 1854, oats; 1853, pasture. No. V. was a very good take of grass, composed of red clover, nearly as close as it could grow, with a very little Italian and perennial rye-grass mixed. No. VI., though rather the heaviest crop, was not so closely planted; there was a fair sprinkling of red clover pretty equally over it all; but it was composed chiefly of Italian and perennial ryegrass mixed; the soil of No. VI. is greatly superior in quality to No. V. Here it will be observed that there is not much difference between the results of guano applied all at one time, and nitrate of soda applied at three different times: there is a loss by applying guano at three different times: it is not sufficiently quick in its action for the last application to have had time to do much good, though it got a sufficient quantity of rain to wash it well in. This is nearly in accordance with all my previous experience. This was a peculiarly favourable season for top-dressing grass: for several weeks in the end of May and beginning of June we had occasional wet days, without any great fall of rain to wash away the manures; and in a favourable season I have generally found 3 cwt. of guano equal to 2 cwt. nitrate of soda; but when a dry season occurs, nitrate of soda has the decided advantage. Even if guano is applied on a wet day, and apparently well washed in—if it should immediately after set in some weeks of dry weather—I have always observed that it has not nearly the same effect as it has when the weather continues damp for some time after; while nitrate of soda, if once washed in, never loses its effect. Taking this into consideration, along with the fact that it requires less rain to wash it in, I consider nitrate of soda decidedly preferable to guano as a manure for grass, and at the relative prices this year more economical. Guano should only be used when the weather is favourable for getting it applied in April; when this can be done, it answers very well to apply a moderate quantity of it, and then apply a little nitrate of soda some time in May. It is the general opinion that the effects of nitrate of soda are more completely exhausted by the first crop than those of

guano; but I have not found this to be the case. I have only twice followed out the results of an experiment upon the crop succeeding the one to which it was applied, and in both, the lots dressed with nitrate of soda and sulphate of ammonia had the advantage over those done with guano; and whenever I have applied 2 cwt. nitrate of soda per acre to grass, the effect of it on the succeeding crop of oats could always be distinctly observed by the eye. There is little difference between nitrate of soda and sulphate of ammonia when applied in the same way. Not wishing to have too many lots in the experiment, I did not use the sulphate in both ways. In No. V. the nitrate is best, and in No. VI. the sulphate; previously I have generally found a similar result between them on grass—if anything, nitrate rather the best; so I always use either of them that I can buy cheapest.

EXPERIMENT VII.—ON ORKNEY RED POTATOES; planted 30th April. Manures all applied the same day. The Superphosphate and Nitrate of Soda, and Sulphate of Ammonia, applied to Lots 8 and 9 in both experiments, were mixed, a month previous to use, in the proportion of 1 cwt. Nitrate and Sulphate to 5 cwt. Superphosphate, making its cost 10s. 2d. per cwt.

No.	MANURES PER ACRE.	Cost of Manure per Acre	Produce of Sound Potatoes.	Price per Ton.	Value per Acre	Prod of Diseased.	Value per Acre	Total Value per Acre.	Gain.	Loss.
		L. s. D.	ton cwt	L.	L. s.	cwt.	s. D.	L. s. D.	L. s. D.	L. s. D.
1.	4 cwt. Guano, ...	2 10 0	10 9	3	31 7	6	6 0	31 13 0	6 7 0	..
2.	6 cwt. Sulphate of Potash,	2 8 0	7 10	..	22 10	6	6 0	22 16 0	..	2 8 0
3.	6 cwt. Superphosphate, .	2 11 0	9 15	..	29 5	3	3 0	29 8 0	4 1 0	..
4	8 cwt Rape-Cake, . . .	2 10 0	8 11	..	25 13	9	9 0	26 2 0	0 16 0	..
5.	6 cwt. Bailey's Manure, .	2 11 0	8 11	..	25 13	3	3 0	25 16 0	0 9 0	..
6.	{2 cwt. Guano, and 3 cwt. Sulph. of Potash,}	2 9 0	8 13	..	25 19	6	6 0	26 5 0	1 0 0	..
7.	{3 cwt. Sulph. of Potash, 3 cwt. Supherphosphate,}	2 9 6	8 11	..	25 13	4½	4 6	25 17 6	0 12 0	..
8.	{5 cwt. Superphosphate and Nitrate of Soda, .}	2 10 10	7 19	..	23 17	9	9 0	24 6 0	.	1 0 0
9	{5 cwt. Superphosphate and Sulph. of Ammonia,}	2 10 10	9 16	..	29 8	4½	4 6	29 12 6	4 6 6	..
10.	Nothing.	..	7 10	..	22 10	6	6 0	22 16 0	..	..

EXPERIMENT VIII.—ON WHITE ROCK POTATOES; planted 5th May. Manures all applied same day.

No.	MANURES PER ACRE.	Cost of Manure per Acre.	Produce of Sound Potatoes.	Price per Ton	Value per Acre.	Prod. of Diseased.	Value per Acre.	Total Value per Acre.	Gain.	Loss.
		L. s. D.	ton cwt.	L.	L. s	cwt.	L. s.	L. s. D	L. s. D.	L. s. D.
1.	4 cwt. Guano..	2 10 0	6 19	3	20 17	37	37 0	22 4 0	0 10 0	..
2.	6 cwt. Sulphate of Potash,	2 8 0	6 3	..	18 9	13	13 0	19 2 0	..	2 10 0
3.	6 cwt. Superphosphate, .	2 11 0	6 3	..	18 9	12	12 0	19 1 0	..	2 14 0
4.	8 cwt. Rape-Cake, . . .	2 10 0	7 15	..	23 5	8	8 0	23 13 0	1 19 0	..
5.	5 cwt. Bailey's Manure, .	2 11 0	6 14	..	20 2	12	12 0	20 14 0	..	1 1 0
6.	{2 cwt. Guano, and 3 cwt. Sulph. of Potash,}	2 9 0	6 14	..	20 2	9	9 0	20 11 0	..	1 2 0
7.	{3 cwt. Sulph. of Potash, 3 cwt. Superphosphate,}	2 9 6	6 9	..	19 7	14	14 0	20 1 0	..	1 12 6
8.	{5 cwt. Superphosphate and Nitrate of Soda, .}	2 10 10	6 8	..	18 9	14	14 0	19 3 0	..	2 11 10
9.	{5 cwt. Superphosphate and Sulph. of Ammonia,}	2 10 10	7 2	..	21 6	15	15 0	22 1 0	0 6 2	..
10.	Nothing.	..	6 2	..	18 6	18	18 0	19 4 0	..	..

Remarks on Nos. VII. and VIII.—No VII. was made on the farm of Eccles-Newtown, on a piece of clay soil naturally very wet, but easily drained, having a mixture of sand in the subsoil; furrow-drained at 30 feet wide; limed eighteen years ago. Previous cropping—1856, oats; 1855, grass, top-dressed with 1 cwt. guano and 1 cwt. nitrate of soda per acre, and cut twice for soiling; 1854, wheat; 1853, Swedish turnip; 1852, oats. It was all dunged in the autumn with 16 loads of dung per acre, on the stubble, and ploughed 12 inches deep with three horses. No. VIII. made on the farm of Eccles-Newtown, on a piece of clay soil, upon an open subsoil; drained at 30 feet wide, and limed in 1855 with 7½ tons per acre of quicklime. Previous cropping—1856, wheat; 1855, Swedish turnip; 1854, pease; 1853, wheat. It was all dunged on the stubble with 16 loads of dung per acre, and ploughed about 9 inches deep with two horses. I have only before this tried one exact experiment upon potatoes, and in it the best result followed from a mixture of guano and sulphate of potash: 6 cwt. guano per acre, without any dung, produced 8 tons per acre, while 3 cwt. guano and 3 cwt. sulphate of potash produced 11½ tons. Guano, mixed with muriate of potash and Bailey's Manure, left a better result than any of them singly. This season, on the average of the two experiments, guano alone leaves rather the best result; the mixture of it with sulphate of potash is a failure. The next best is superphosphate and sulphate of ammonia: it is rather singular that superphosphate and nitrate of soda should fall so much behind it. The third best is rape-cake, though there is something anomalous in the circumstance, that in No. VIII. it is the best of any, and in No. VII. among the lowest. Superphosphate alone, though pretty good, is considerably behind the mixture of it and sulphate of ammonia. Sulphate of potash alone is a total failure; it was the same last year, even though, when then combined with guano, it was the best.

Experiment IX. — On Swedish Turnip. Sown 15th May; Manures all applied at the same time; lifted and weighed on 19th November. Made on the farm of Eccles, on a piece of clay soil upon an open subsoil, furrow-drained at 30 feet, and limed in 1854 with 7½ tons quicklime per acre. Previous cropping—1856, barley, manured with 2 cwt. guano per acre; 1855, wheat, manured with 12 loads dung per acre; 1854, bare fallow; 1853, beans. In addition to the special manures, it all got 15 loads dung per acre, applied in the drills at the time of sowing.

Manures per Acre.	Cost of Manures per Acre. £	s.	d.	Produce per Acre. Tons.	cwt.	qrs.
No. 1.—3 cwt. Guano,	1	17	6	14	1	1
„ 2.—4½ cwt. Superphosphate,	1	18	3	13	15	2
„ 3.—3¾ cwt. Superphosphate and Sulphate of Ammonia, mixed 5 to 1,	1	18	1½	13	10	0
„ 4.—3¾ cwt. Superphosphate and Sulphate of Ammonia, mixed 10 to 1,	1	17	8	14	6	3
„ 5.—3¾ cwt. Superphosphate and Nitrate of Soda, mixed 5 to 1,	1	18	1½	14	1	1
„ 6.—3¾ cwt. Superphosphate and Nitrate of Soda, mixed 10 to 1,	1	17	8	13	10	0

EXPERIMENT X.—ON SWEDISH TURNIPS. Sown 27th May; lifted and weighed 5th December. Made on the farm of Eccles, on a piece of clay soil upon an open subsoil, furrow-drained at 30 feet; had got no lime for a great number of years. Previous cropping—1856, wheat, manured when sown with 4 cwt. rape-cake per acre, and top-dressed in the spring with 1 cwt. sulphate of ammonia; 1855, beans; 1854, oats. It all got 10 loads dung per acre, applied in the drills at the time of sowing.

Manures per Acre.	Cost of Manures per Acre. £ s. d.	Produce per Acre. Tons. cwt. qrs.
No. 1.—3 cwt. Guano,	1 17 6	15 17 3
„ 2.—4½ cwt. Superphosphate,	1 18 3	15 0 3
„ 3.—3¾ cwt. Superphosphate and Sulphate of Ammonia, mixed 5 to 1,	1 18 1½	15 9 3
„ 4.—3¾ cwt. Superphosphate and Sulphate of Ammonia, mixed 10 to 1,	1 17 8	15 3 3
„ 5.—3¼ cwt. Superphosphate and Nitrate of Soda, mixed 5 to 1,	1 18 1½	15 18 0
„ 6.—3¾ cwt. Superphosphate and Nitrate of Soda, mixed 10 to 1,	1 17 8	15 9 2
„ 7.—4½ cwt. Sewage Manure,	1 16 0	13 18 0
„ 8.—4½ cwt. Odam's Blood-Manure,	1 16 0	15 6 0

EXPERIMENT XI.—ON WHITE GLOBE TURNIPS. Sown 5th June; lifted and weighed 3d November. Made on the farm of Eccles-Newtown, on a piece of light soil upon a moorland subsoil, in its natural state, all covered with whins and heather; furrow-drained at 30 feet, and limed in 1854 with 5½ tons quicklime per acre. Previous cropping—1856, pasture; 1855, barley; 1854, turnip; 1853, oats. This got no dung.

Manures per Acre.	Cost of Manures per Acre. £ s. d.	Produce per Acre. Tons. cwt. qrs.
No. 1.—4 cwt. Guano,	2 10 0	21 15 0
„ 2.—6 cwt. Superphosphate,	2 11 0	20 12 2
„ 3.—5 cwt. Superphosphate and Sulphate of Ammonia, mixed 5 to 1,	2 10 10	19 17 2
„ 4.—5 cwt. Superphosphate and Sulphate of Ammonia, mixed 10 to 1,	2 7 0	24 7 2
„ 5.—5 cwt. Superphosphate and Nitrate of Soda, mixed 5 to 1,	2 10 10	18 15 0
„ 6.—5 cwt. Superphosphate and Nitrate of Soda, mixed 10 to 1,	2 7 0	21 0
„ 7.—6 cwt. Bailey's Manure,	2 8 0	18 15 0
„ 8.—7½ cwt. Wool Manure,	2 8 9	18 7 2
„ 9.—6 cwt. Sewage Manure,	2 8 0	15 0 0
„ 10.—6 cwt. Odam's Blood Manure,	2 8 0	19 17 2
„ 11.—6 cwt. Calcined Bones,	2 11 0	18 7 2

EXPERIMENT XII.—ON WHITE GLOBE TURNIPS. Sown 26th June; lifted and weighed on 8th December. Made on the farm of Eccles, on a piece of clay soil upon an open subsoil; furrow-drained at 30 feet; had got no lime for a number of years past. Previous cropping—1856, oats; 1855, pasture; 1854, wheat; 1853, turnips. It all got 10 loads dung per acre applied in the drills at the time of sowing.

Manures per Acre.	Cost of Manures per Acre. £ s. d.	Produce per Acre. Tons. cwt. qrs.
No. 1.—4 cwt. Guano,	2 10 0	13 10 0
„ 2.—6 cwt. Superphosphate,	2 11 0	11 1 1
„ 3.—5 cwt. Superphosphate and Sulphate of Ammonia, mixed 5 to 1,	2 10 10	12 8 3
„ 4.—5 cwt. Superphosphate and Sulphate of Ammonia, mixed 10 to 5,	2 7 0	13 0 1
„ 5.—5 cwt. Superphosphate and Nitrate of Soda, mixed 5 to 1,	2 10 10	12 7 2

EXPERIMENT XII.—*continued.*

Manures per Acre.	Cost of Manures per Acre. £ s. d.	Produce per Acre. Tons. cwt. qrs.
No. 6.—5 cwt. Superphosphate and Nitrate of Soda, mixed 10 to 1,	2 7 0	11 8 3
„ 7.—6 cwt. Bailey's Manure,	2 8 0	10 17 2
„ 8.—7½ cwt. Wool Manure,	2 8 9	12 0 0
„ 9.—6 cwt. Sewage Manure,	2 8 0	10 2 2
„ 10.—6 cwt. Odam's Blood-Manure,	2 8 0	9 18 3
„ 11.—5¼ cwt. West Indian Guano,	2 9 6	10 10 0
„ 12.—4½ cwt. Ammoniacal Bones,	2 7 6	13 10 0

The manures used in Nos. 3, 4, 5, and 6 were prepared by mixing 5 and 10 cwt. superphosphate respectively as marked, with 1 cwt. sulphate of ammonia and nitrate of soda a month before they were applied.

AVERAGE RESULT OF THE FOUR EXPERIMENTS ON TURNIPS.

No.	Guano.	Superphosphate.	Superphosphate and Sulphate of Ammonia, mixed 5 to 1.	Superphosphate and Sulphate of Ammonia, mixed 10 to 1	Superphosphate and Nitrate of Soda, mixed 5 to 1.	Superphosphate and Nitrate of Soda, mixed 10 to 1.
	Tons. cwt. qr	Tons. cwt. qr	Tons cwt qr.	Tons. cwt. qr.	Tons. cwt. qr	Tons cwt. qr
9	14 1 1	13 15 2	13 10 0	14 6 3	14 1 1	13 10 0
10	15 17 3	15 0 3	15 9 3	15 3 3	15 18 0	15 9 2
11	21 15 0	20 12 2	19 17 2	24 7 2	18 15 0	21 0 0
12	13 10 0	11 1 1	12 18 3	13 0 1	12 7 2	11 8 3
	65 3 0	60 10 0	61 16 0	66 18 1	61 1 3	61 8 1
	16 5 3	15 2 2	15 9 0	16 14 2¼	15 5 1¾	15 7 0¼

Remarks on Turnip Experiments.—In this district the crop of turnip this year was the worst that has been grown for many years past; they brairded very well, and did not in general suffer much from the fly, and were ready for thinning about the usual time; but they made very little progress for some weeks after, and were late at the beginning of August. We then had several weeks of fine growing weather, during which they made rapid progress, and in the middle of September had a very promising appearance; but it then set in a few weeks of very dry weather, and they were attacked with mildew, and never grew any more, even though we had fine weather in November. The early-sown ones were fully a third deficient, and the late-sown were not half a crop. In an exceptional season like this, the results of an experiment with different manures cannot have the same value as when the crop is generally a good one. It is known that while some manures have the effect of forcing on the turnip rapidly in the first stages of its growth, others have more effect during the latter stages; and what we want to find out is, what manure has the most beneficial effect through all the period in which the turnip usually makes its principal growth. Now the growth of the turnip having stopped almost entirely in the beginning of October—the month during which they usually

root most—the manures that are slowest in their action could not have a fair trial: had the turnips continued to grow all through the autumn as they usually do, it is likely that the comparative results would have been a little different. As it is, it will be seen that superphosphate and sulphate of ammonia mixed 10 to 1 gives the largest return; had they been a full crop, the results would perhaps have been comparatively better from all the superphosphate lots. I have generally observed that turnips grown with any preparation of bones retain the greenness in the shaw longer than those grown either with guano or dung, while those grown with guano come most quickly to maturity. This is the first time that I have tried superphosphate mixed with sulphate of ammonia on turnips. I have often made experiments with it mixed with guano, and have always found that I could grow a greater weight with the two combined than with either of them singly; but as this year the trials were undertaken with the view of finding a substitute for guano, I could not use it in that manner; so I had recourse to sulphate of ammonia and nitrate of soda as the only other means at command for supplying the amount of ammonia that previously I had found necessary for raising a full crop of turnip on clay soils. I have always found that though on light soils I could sometimes grow as good a crop with bones alone or other manures composed chiefly of phosphates, as with guano, on clay soils I could not. A supply of ammonia seems absolutely necessary for the free growth of the turnip on them; and the majority of my experiments this year were made on clay soils. I did not know very well in what proportions to mix them, so I tried them both at 1 to 5 and 1 to 10; the latter proportion answers best, though it will be seen that all the mixed lots yield a larger increase than the superphosphate alone. In No. XII. there is also a trial with ammoniacal bones, which I believe were just superphosphate prepared with a little sulphate of ammonia; they were sent to me along with the West Indian guano for trial, by a dealer in this district, near the end of the turnip season. They show a similar result, being better than pure superphosphate, and as good as guano. There are also a few trials of the different manures that I was induced to purchase during the course of the season. I generally test all the manures that I use every season, and if I find that any manufacturer gives me a bad article one season, I buy no more from him. Those tried this year all show a pretty good result, except the sewage manure, which is deficient; I got it from Hull. The West Indian guano is also a failure.

The conclusion to be drawn from the preceding experiments appears to me to be this, that we need not now consider that a supply of guano is absolutely necessary for keeping up the fertility of the soil, as there are other substances at command, by which it can be done equally well, and that it is only a question of relative cost. On turnips—the crop to which by far the largest quantity of the

artificial manure used in this district is at present applied—superphosphate and sulphate of ammonia are quite equal to it; on wheat, sulphate of ammonia is greatly superior to it; on oats, there is not much difference between it and nitrate of soda; and on grass, nitrate of soda is better. It must also be taken into consideration, that though there is a rise in the price of nearly all the manures I tried since the time I bought them, the rise on the price of guano is relatively greater than on most of the others. This year I have paid 8 per cent additional for guano and nitrate of soda, and only 5 per cent on superphosphate and sulphate of ammonia. Rape-cake I can still buy at the same price. I believe that if it were possible to get a larger importation of nitrate of soda, and at a cheaper rate, it would be one of the greatest boons that could be rendered to agriculture. The supply of it is said to be unlimited, and the cost to consist chiefly in the labour of preparing and transporting it to the sea-coast. Now, could the means of doing these be improved, and the expense lessened, a reduction in the price of guano must soon follow, else the demand for it would quickly fall off. As it is, I believe that there will be much less of it used in proportion to other manures in the ensuing year than there used to be formerly. For my own part, for some years back, nearly half of the artificial manures I bought every year consisted of guano, but this year about four-fifths of them consisted of other manures, and only one-fifth of guano. In this report the term guano always implies Peruvian guano, unless when otherwise mentioned.

APPENDIX.

More than a year having passed since the foregoing report was written, and as it may be interesting to compare the effects of the same manures on the various crops, in two years of different character, I have been requested to add the results of the experiments which I carried out in 1858.

The year 1857 was in this district peculiarly favourable for applying manure as a top-dressing to the cereal and grass crops—there having been a sufficient supply of moisture during the proper season of application, and, from the previous cold weather, the crops in general looked rather backward, and in need of assistance. The year 1858 was quite different in its character. All the crops—more particularly the wheat—looked remarkably well in spring; but, during the next month or two, the supply of moisture was too limited to enable any manure applied as a top-dressing to produce its full effect, even though the crop had been backward-looking and in need of assistance; but, as the weather at the same time was seasonably mild, the crops continued to make very good progress. With regard to the turnip crop it was very different. In 1857 it made a very good start, and looked promising in the first stages of its growth; but it stopped all at once. In 1858 it never

looked worse than it did in the month of August, but it then made a start and continued growing up till the New-Year, and turned out a very good crop.

In selecting the manures to try against guano, I only made use of those which, in previous years, I had found to answer best. These I found to be nitrate of soda for oats; sulphate of ammonia for wheat and barley; nitrate of soda, or sulphate of ammonia, for grass; and superphosphate, containing a per-centage of ammonia, for turnips and potatoes. So I confined my attention chiefly to these.

Experiment I.—On Potato Oats. Sown, 25th March; the guano applied at time of sowing; the nitrate of soda at three different times—viz. 13th May, 26th May, and 12th June. Cut 17th August.

No.	Manures per Acre.	Cost of Manure per Acre.	Produce of Good Corn per Acre.	Weight per Bush.	Price per Bush.	Value of Good Corn per Acre.	Produce of Light Corn per Acre	Weight of Light Corn per Bush.
		L. s. D.	bush. lb.	lb.	s. D.	L. s. D.	bush. lb.	lb.
1.	2 cwt. Guano, . . .	1 8 0	46 15	42	3 0	6 19 0	2 12	36
2.	11 st. Nitrate of Soda,	1 8 2½	45 4	42½	3 0½	6 17 1½	1 6	36
3.	Nothing, ...	..	34 19	42½	3 0½	5 4 11	3 16	36

No.	Price of Light Corn per Bush.	Value of Light Corn.	Produce of Straw and Chaff.	Price per Cwt.	Value of Straw.	Total Value of Crop per Acre.	Gain from Application.
	s. D.	s. d.	cwt. st.	s. P.	L. s. D.	L. s D.	s. D.
1.	2 4	5 5	21 1	1 6	1 11 8	8 16 1	13 3
2.	2 4	2 9½	20 6	1 6	1 11 0	8 10 10½	7 10
3.	2 4	8 2	14 4	1 6	1 1 9	6 14 10	..

Experiment II.—On Potato Oats. Sown 27th March; the guano applied at the time of sowing; the nitrate of soda at three different times—viz. 30th April, 13th May, and 16th June. Cut 19th August.

No.	Manures per Acre.	Cost of Manure per Acre.	Produce of Good Corn per Acre.	Weight per Bush.	Price per Bush.	Value of Good Corn per Acre.	Produce of Light Corn per Acre.	Weight of Light Corn per Acre.
		L. s. D.	bush. lb.	lb.	s. D.	L. s. D.	bush. lb.	lb.
1.	2 cwt Guano, . . .	1 8 0	36 0	43	3 1	5 11 0	4 28	38
2.	11 st. Nitrate of Soda,	1 8 2½	40 0	42	3 0	6 0 0	5 3	37
3.	Nothing, ...	..	30 0	43	3 1	4 12 6	4 20	38

No.	Price of Light Corn per Bush.	Value of Light Corn.	Produce of Straw and Chaff.	Price per Cwt.	Value of Straw.	Total Value of Crop per Acre.	Gain from Application.
	s. D.	s. D.	cwt. st.	s. D.	L. s. D.	L. s. D.	D.
1.	6	11 11	26 2	1 6	1 19 5	8 2 4	0 7
2.	2 5	12 3	26 6	1 6	2 2 0	8 12 5	10 5½
3.	2 6	11 3	20 0	1 6	1 10 0	6 13 9	..

Remarks on Nos. I. and II.—No. I. was made on the farm of Eccles, on strong clay soil, drained three years before, 4 feet deep and 28 feet wide, and limed with 7½ tons per acre the same year. Previous cropping:—1857, pasture; 1856, wheat; 1855, summer fallow; 1854, oats. No. II. was made on the farm of Eccles-Newtown, on a free clay soil, drained 20 feet apart; had not been limed for twenty years. Previous cropping:—1857, grass—cut twice for soiling; 1856, wheat; 1855, Swedish turnip—all carried off; 1854, wheat; 1853, beans. It will be observed that there is a difference in the times when the nitrate was applied to Nos. I. and II. On the 30th April we had a pretty heavy shower, and I got the nitrate applied to No. II. while it was falling; but, before I could apply it to No. I. it had cleared up, and the land was drying so quickly that I considered there was not sufficient moisture left to wash it in. We had no more rain till the 13th May, which was rather late for the first application, and it will be noticed that the earliest applied had decidedly the best relative effect. On the average of the two, the nitrate has the advantage over guano—on the one that was applied in proper time, a very decided one. This I believe is to be attributed chiefly to the dry character of the season. I have observed that, during a long course of dry weather, guano appears to exert little influence on the growth of the young plant, even though it is well mixed with the soil, and has had some influence on its previous growth during wet weather; while nitrate, if it has once begun to take effect, does not seem to be much influenced by the subsequent character of the weather. This was very marked this year; during the tracts of dry weather we had, I could not notice much difference between the growth of the guano lots and those that had got nothing, while the lots that had got nitrate could be observed taking the lead; but, whenever rain came, in a few days the guano was at once seen to be causing a vigorous growth.

EXPERIMENT III.—ON BARLEY. Sown, 15th April; Nos. 1 and 2 applied at time of sowing. No. 3 at three different times,—viz. 13th May, 26th May, and 12th June. Cut 18th August.

No.	Manures per Acre.	Cost of Manure per Acre	Produce of Good Corn per Acre	Weight per Bush.	Price per Bush.	Value of Good Corn	Produce of Light Corn	Weight of Light per Bush.
		L. s. D	bush. lb	lb	L s. D.	L. s. D.	bush. lb	lb.
1.	2 cwt. Guano, and 2 cwt. Salt, ...	1 10 6	43 14	53¾	0 3 7½	7 17 7¼	4 12	50
2.	2 cwt. Dissolved Bones, and 4 lb. Sulphate of Ammonia, and 2 cwt. Salt, ...	1 10 6	40 40	54¼	0 3 8¼	7 10 3	5 35	50½
3.	1¼ cwt. Sulphate of Ammonia, and 2 cwt. Salt,	1 10 0	43 38	54	0 3 8	8 0 2	3 13	48
4.	Nothing	..	35 11	55	0 3 9	6 12 0	3 43	49

EXPERIMENT III.—*Continued.*

No.	Price of Light Corn per Bush.	Value of Light Corn per Acre.	Produce of Straw and Chaff per Acre.	Price per Cwt.	Value of Straw per Acre.	Total Value of Crop per Acre.	Gain from Application.
	s. D.	L. s. D.	cwt. st.	s. D.	L. s. D.	L. s. D.	s. D.
1.	3 2	0 13 5	25 0	1 3	1 11 3	10 2 3½	7 3½
2.	3 2	0 16 10	22 4	1 3	1 8 7½	9 15 8¼	0 8¼
3.	3 0	0 9 9	25 6	1 3	1 12 2½	10 2 1½	7 7½
4.	3 1	0 12 0	16 3	1 3	1 0 6	8 4 6	..

Remarks on No. III.—This experiment was made on the farm of Eccles, on a piece of loamy clay soil, drained at 30 feet, and limed with 7½ tons per acre three years before. Previous cropping:—1857, beans; 1856, wheat; 1855, turnips—all carried off; 1854, oats. Here it will be observed that guano and nitrate are nearly equal; both show a fair result. Dissolved bones do not answer so well.

EXPERIMENT IV.—ON WHEAT (Browick Red). No. 1 was applied 27th April and harrowed in. Nos. 2 and 3 were applied at three different times, viz. 30th April, 13th May, and 4th June. The wheat was sown on 22d October, after tares, and all manured with 5 cwt. per acre of ground rape-cake. Cut 16th August.

No.	Manures per Acre.	Cost of Manure per Acre	Produce of Good Corn per Acre	Weight per Bush.	Price per Bush.	Value of Good Corn.	Produce of Light Corn	Weight per Bush.
		L. s.	Bush. lb	lb.	s. D	L. s. D.	Bush. lb.	lb.
1.	1½ cwt. Guano, ...	1 1	43 47	61½	5 0¾	10 19 9	1 29	55
2.	1 cwt. Sulphate of Ammonia, ...	1 0	43 0	61½	5 0½	10 15 10¾	1 0	55
3.	2 cwt. Sulphate of Ammonia, ...	2 0	44 32	61	5 0	11 2 8	0 46	55
4.	Nothing, ...	..	41 28	60½	4 11½	10 5 7½	0 30	55

No.	Price of Light Corn per Bushel.	Value of Light Corn per Acre.	Produce of Straw & Chaff per Acre	Price per Cwt	Value of Straw per Acre.	Total Value of Crop per Acre	Loss from Application.
	s. D.	s. D.	cwt. st.	s. D.	L. s. D.	L. s. D.	s. D.
1.	4 0	6 0	37 0	1 3	1 6 3	13 12 0	0 9½
2.	4 0	4 0	39 2	1 3	2 9 0	13 8 10¾	2 10½
3.	4 0	3 8	40 6	1 3	2 10 11	13 17 3	14 5½
4.	4 0	2 2	35 2	1 3	2 4 0	12 11 9½	.. ..

Remarks on No. IV.—This experiment was made on the farm of Eccles-Newtown, on a strong clay soil with a good open subsoil, drained at 30 feet; had got no lime for eighteen years. Previous cropping:—1857, tares; 1856, oats; 1855, grass, cut twice for soiling; 1854, wheat. Here it will be observed that guano has rather the advantage over the sulphate of ammonia. In all my experiments on wheat, it is the first time this has occurred. Neither of them had their usual effect: I never could notice any difference in the appearance of the manured and unmanured lots

at any period of their growth. The wheat was looking very well at the time they were applied, and they all turned out a bulky crop. They were all laid a little, but nothing to cause any injury.

EXPERIMENT V.—ON POTATOES (Orkney Reds). Planted 13th April; manures all applied at time of planting; lifted and weighed on 2d October.

No.	Manures per Acre.	Cost of Manure per Acre	Produce of Sound Potatoes.	Price per Ton.	Value per Acre.	Prod. of Diseased.	Value per Acre.	Total Value per Acre.	Gain from Application.
		L. s. D.	ton cwt.	L.	L. s.	cwt.	s. D.	L. s. D.	L. s. D.
1.	4 cwt. Guano, and 2 cwt. Salt, .	2 18 6	9 12	40	19 4	14	14 0	19 18 0	3 14 6
2.	2 cwt. Guano, 2 cwt. Sulphate of Potash, and 2 cwt. Salt, .	2 19 0	10 3	..	20 6	16	16 0	21 2 0	4 18 0
3.	6 cwt. of dissolved Bones, and 2 cwt. Salt, ...	2 16 6	8 17	..	17 14	14	14 0	18 8 0	2 6 6
4.	8 cwt. Rape-Cake, and 2 cwt. Salt,	2 16 6	9 0	..	18 0	16	16 0	18 16 0	2 14 6
5.	3 cwt. Rape-Cake, 3 cwt. Dissolved Bones, 4 st. Sulphate of Ammonia, and 2 cwt. Salt,	2 17 3	9 19	..	19 18	8	8 0	20 6 0	4 3 9
6.	6 cwt. Bailey's Manure, and 2 cwt. Salt, ...	2 16 6	9 12	..	19 4	4	4 0	19 18 0	3 6 *3
7.	Nothing, ...	..	6 9	..	12 18	7	7 0	13 5 0	..

EXPERIMENT VI.—ON POTATOES (White Rocks). Planted 21st April; manures all applied at time of planting; lifted and weighed on 29th September.

No.	Manures per Acre.	Cost of Manure per Acre.	Produce of Sound Potatoes.	Price per Ton.	Value per Acre.	Prod. of Diseased.	Value per Acre.	Total Value per Acre.	Gain from Application.	Loss.
		L. s. D.	ton cwt.	L.	L. s.	cwt.	s. D.	L. s. D.	L. s. D.	L. s. D.
1.	4 cwt. Guano, ...	2 18 6	11 16	40	23 12	24	24 0	24 16 0	2 0 0	..
2.	2 cwt. Guano and 3 cwt. Sulph. of Potash,	2 19 0	12 6	..	24 12	27	27 0	25 19 0	3 2 6	..
3.	6 cwt. Dissolved Bones, .	2 16 6	10 10	..	21 0	13	13 0	21 18 0	..	1 1 0
4.	8 cwt. Rape-Cake, ...	2 16 6	11 5	..	22 10	13	13 0	23 8 0	0 9 0	..
5.	3 cwt. Rape-Cake, 3 cwt. Dissolved Bones, 4 st. Sulph. of Ammonia,	2 17 3	11 5	..	22 10	16	16 0	23 6 0	0 18 6	..
6.	6 cwt. Bailey's Manure, .	2 16 3	10 19	..	21 18	18	18 0	22 16 0	0 2 0	..
7.	Nothing, ...	..	9 15	..	19 10	10	10 0	20 0 0	..	..

Remarks on Nos. V. and VI.—No. V. was made on the farm of Eccles, on an open clay soil, with a good subsoil, drained at 30 feet. Previous cropping:—1857, oats; 1856, pasture; 1855, barley; 1854, white turnip, half eaten on the ground. There was no farmyard manure applied to the potato crop. No. VI. was made on the farm of Eccles-Newtown, on an open clay soil, drained at 20 feet. Previous cropping:—1857, wheat; 1856, beans; 1855, wheat; 1854, tares. Twelve cart-loads of well-rotted dung were applied on the stubble in the autumn, and ploughed in. Taking the average of these two experiments, the mixture of guano and sulphate of potash leaves decidedly the best result. Last year the same mixture was a comparative failure, while the year before it was again the best. Sulphate of potash seems to be very variable in its action on the potato crop. Of the others, guano is the best, though the mixture of rape-cake, dissolved bones, and sulphate of ammonia is not much behind it.

EXPERIMENT VII.—ON GRASS. No. 1 was applied on the 30th April. Nos. 2 and 3 were applied at three different times—viz. 30th April, 18th May, and 12th June. Cut 1st July; weighed 27th July.

No.	Manures per Acre.	Cost of Manures per Acre.			Produce of Hay.		Price per Ton.			Total Value.			Loss from Application.		
		L.	s.	D.	ton.	cwt.	L.	s.	D.	L.	s.	D.	L.	s.	D.
1.	3 cwt. Guano, . . .	2	2	0	1	15	3	10	0	6	2	6	1	8	0
2.	2 cwt. Nitrate of Soda, .	2	1	0	2	0		...		7	0	0	0	9	6
3.	2 cwt. Sulph. of Ammonia,	2	0	0	1	17		...		6	9	6	0	19	0
4.	Nothing, ...		...		1	11		...		5	8	6		...	

Remarks on No. VII.—This experiment was made on the farm of Eccles, on a loamy soil, drained at 30 feet. Previous cropping:—1857, wheat; 1856, white turnips—all carried off; 1855, oats; 1854, pasture. The grass was rather thinly planted, but all the lots were pretty equal in that respect. It was too dry weather for top-dressing grass, consequently all the manures show a loss, but the nitrate is much better than the guano.

EXPERIMENT VIII.—ON SWEDISH TURNIP. Sown 12th May; manures all applied at same time; lifted and weighed on 10th January. Made on the farm of Eccles, on a free clay soil, with a good subsoil, drained at 30 feet, and limed with 7½ tons per acre four years before. Previous cropping:—1857, wheat; 1856, tares; 1855, barley; 1854, turnip. In addition to the special manures, it all got 15 loads dung per acre at the time of sowing.

Manures per Acre.	Cost per Acre. L.	s.	D.	Produce per Acre. Tons.	cwt.	st.
No. 1.—2 cwt. Guano, ...	1	8	0	21	0	0
„ 2.—3 cwt. Dissolved Bones, ...	1	7	0	22	2	4
„ 3.—2 cwt. 6 st. Dissolved Bones and Sulphate of Ammonia mixed, 10 to 1, . . .	1	7	6	18	15	0
„ 4.—4 cwt. Rape-Cake, ...	1	7	0	20	12	0
„ 5.—Nothing, ...		...		17	5	0

EXPERIMENT IX.—ON SWEDISH TURNIP. Made on the same field as No. VIII., and sown and lifted the same day; but it got no farmyard manure, and double quantity of the specials.

Manures per Acre.	Cost per Acre. L.	s.	D.	Produce per Acre. Ton.	cwt.
No. 1.—4 cwt. Guano, ...	2	16	0	22	10
„ 2.—6 cwt. Dissolved Bones, ...	2	14	0	20	5
„ 3.—5 cwt. 4 st. Dissolved Bones and Sulphate of Ammonia, 10 to 1, ...	2	15	0	18	0
„ 4.—8 cwt. Rape-Cake, ...	2	14	0	19	10

EXPERIMENT X.—ON PURPLE-TOP YELLOW TURNIP. Sown 11th June; lifted and weighed 10th November. Made on the farm of Eccles, on a strong clay soil, that I believe had never grown turnip before. Drained at 28 feet, and limed with 8 tons per acre four years before. Previous cropping:—1857, wheat; 1856, beans; 1855, wheat; 1854, bare fallow. In addition to the special manures it all got 20 cart-loads of dung on the stubble, and ploughed 12 inches deep.

Manures per Acre.	Cost per Acre. L.	s.	D.	Produce per Acre. Ton.	cwt.	st.
No. 1.—2 cwt. Guano, ...	1	8	0	11	7	4
„ 2.—3 cwt. Dissolved Bones, ...	1	7	0	12	17	4
„ 3.—2 cwt. 6 st. Dissolved Bones and Sulphate of Ammonia, 10 to 1, ...	1	7	6	15	2	4
„ 4.—4 cwt. Rape-Cake, ...	1	7	0	13	2	4
„ 5.—Nothing, ...		...		9	10	0

EXPERIMENT XI.—ON WHITE GLOBE TURNIP. Sown 23d June; lifted 17th November. Made on the same field as No. X., and got the same quantity of farmyard manure.

Manures per Acre.	Cost per Acre. L.	s.	D.	Produce per Acre. Ton.	cwt.	st.
No. 1.—2 cwt. Guano,	1	8	0	12	15	0
„ 2.—3 cwt. Dissolved Bones,	1	7	0	13	17	4
„ 3.—2 cwt. 6 st. Dissolved Bones and Sulphate of Ammonia, 10 to 1,	1	7	6	12	7	4
„ 4.—4 cwt. Rape-Cake,	1	7	6	12	2	4
„ 5.—Nothing,	...			10	12	4

EXPERIMENT XII.—ON PURPLE-TOP YELLOW TURNIP. Sown 19th June; lifted 20th November. Made on the farm of Eccles-Newtown, on a poor light soil with a moorland subsoil. Previous cropping:—1857, oats; 1856 and 1855, pasture; 1854, barley. In addition to the special manures it got 12 cart-loads dung at the time of sowing.

Manures per Acre.	Cost per Acre. L.	s.	D.	Produce per Acre. Tons.	cwt.	st.
No. 1.—2 cwt. Guano,	1	8	0	11	5	0
„ 2.—3 cwt. Dissolved Bones,	1	7	0	11	5	0
„ 3.—2 cwt. 6 st. Dissolved Bones and Sulphate of Ammonia, mixed 10 to 1,	1	7	6	13	0	0
„ 4.—4 cwt. Rape-Cake,	1	7	0	10	2	4
„ 5.—Nothing,	...			9	5	0

EXPERIMENT XIII.—ON WHITE GLOBE TURNIP. Sown 21st June; lifted 11th January. Made on the same field as No. XII., but the land was a little better in quality, and on a better subsoil. It got 15 loads dung on the stubble in autumn.

Manures per Acre.	Cost per Acre. L.	s.	D.	Produce per Acre Tons.	cwt.
No. 1.—2 cwt. Guano,	1	8	0	16	10
„ 2.—3 cwt. Dissolved Bones,	1	7	0	17	0
„ 3.—2 cwt. 6 st. Dissolved Bones and Sulphate of Ammonia, mixed 10 to 1,	1	7	6	15	10
„ 4.—4 cwt. Rape-Cake,	1	7	0	17	5
„ 5.—Nothing,	...			12	7

AVERAGE RESULT OF THE SIX EXPERIMENTS ON TURNIP.

No.	Guano.			Dissolved Bones.			Dissolved Bones and Sulph. of Am.			Rape-Cake.		
	Tons.	cwt.	st.	Tons.	cwt.	st.	Tons.	cwt.	st.	Tons.	cwt.	st.
8	21	0	0	22	2	4	18	15	0	20	12	0
9	22	10	0	20	5	0	18	0	0	19	10	0
10	11	7	4	12	17	4	15	2	4	13	2	4
11	12	15	0	13	17	4	12	7	4	12	2	4
12	11	5	0	11	5	0	13	0	0	10	2	4
13	16	10	0	17	0	0	15	10	0	17	5	0
	95	7	4	97	7	4	92	15	0	92	14	4
	15	17	7	16	4	4	15	9	1	15	9	0

Remarks on Turnip Experiments.—Nos. 8 and 9 brairded very well, and escaped the ravages of the fly, so prevalent in this district that season, and were free from blanks. Nos. 10 and 11 also brairded pretty well; but during the ungenial weather we had in July, they

stood still completely; and being on very stiff land, and rather late in being sown, they did not, like the turnip crop in general, make up in the autumn for the lost growth in July. Nos. 12 and 13 suffered severely from the ravages of the fly, and were very blanky: so I do not think that the same reliance can be placed on the results of the four last experiments as on the two first. The manure applied to No. 3 in all the trials was prepared by mixing 10 cwt. dissolved bones with 1 cwt. sulphate of ammonia a month or two before it was used. This, it will be seen, is not so good as the bones alone. Last year the addition of sulphate of ammonia to superphosphate in the same proportion was an improvement to it; but the superphosphate used contained no ammonia. This year I used pure dissolved bones, which, as will be seen by the analysis annexed, contained 2½ per cent of ammonia. This will account for the addition of the sulphate being of no use.

Upon the whole, the experiments of this year do not show any great discrepancy with those of the preceding year, but mostly go to support the results then arrived at. They show that, should the supply of guano be stopped, or the price of it be kept too high, we have now other manures at command, equal to it in their effect on all the crops usually grown in this country. This consideration will contribute to limit the consumpt of guano next year: while it has only been reduced in price £1 per ton since 1857, nitrate of soda has fallen £4 per ton, and dissolved bones and superphosphate from £1 to £2 per ton, which makes them relatively now very much the cheapest.

Analysis by Professor Anderson of the Dissolved Bones used in all the above Experiments.

Water,	13.63
Organic Matter,	22.71
Biphosphate of Lime, equivalent to 13.13 Bone Phosphate, made soluble,	8.41
Insoluble Phosphates,	25.17
Sulphate of Lime,	27.13
Alkaline Salts,	1.58
Sand,	1.32
	100.00
Ammonia,	2.59

On the COMPOSITION and QUALITIES of DIFFERENT KINDS of OIL-CAKE.*

By Professor Anderson, M.D., Chemist to the Society.

The progress of agriculture, and the system of high farming, which have had so remarkable an effect in increasing the use of artificial manures, have operated in a similar manner on the feeding of stock, and stimulated to an extraordinary extent the demand for imported, and what, as distinguished from the ordinary farm crops of this country, may with some degree of justice be termed artificial cattle-foods. So general has the use of these substances become, that on almost every farm where the feeding of stock is extensively practised, purchased food, which is almost entirely of foreign growth, is consumed to a greater or less extent. It is remarkable also that while the market price of the great staple crops of this country, and more particularly of the cereals, is not advancing, that of the imported cattle-foods, and especially of oil-cake, has undergone a decided increase; and as, in spite of this enhanced price, there has been a material addition to the quantity consumed, it must be inferred that its use has been found profitable.

The consumption of oil-cake in this country has now reached an extent of which few persons are aware, and it may be a matter of some interest, if, by way of introduction, I enter into some statistical details on this point. The supply consists partly of imported, and partly of home-made cake. The quantity of the former, including rape-cake, and all other descriptions imported during the eleven years ending 1858, has been—

	Tons		Tons
1848,	73,029	1854,	76,230
1849,	59,462	1855,	80,659
1850,	65,055	1856,	83,256
1851,	55,096	1857,	99,265
1852,	53,616	1858,	80,629
1853,	64,475		

The average of the first four of these years gives 63,255 tons, and of the last four 85,952 tons; so that within that period there has been an increase to the extent of more than 35 per cent. An exact estimate of the value of this quantity cannot be formed unless we know how much consisted of rape and other inferior cakes, but as the quantity of these is small, I believe a very close approximation to the truth may be obtained by assuming the average price of £8 per ton, giving £687,616 for the annual value of imported cake.

* Address delivered at the Monthly Meeting, 14th December 1859.

There is no means of ascertaining directly the quantity of cake manufactured in this country; but it may be estimated indirectly with considerable accuracy from the imports of the different kinds of oil-seed. In the following table are given the quantities of linseed and rape imported in each of the last fifteen years:—

	Linseed.	Rape-seed.		Linseed.	Rape-seed.
1844,	616,947 qrs.	68,884 qrs.	1852,	799,402 qrs.	146,230 qrs.
1845,	656,793 „	47,677 „	1853,	1,035,335 „	86,815 „
1846,	506,141 „	87,662 „	1854,	828,513 „	103,155 „
1847,	439,512 „	47,523 „	1855,	756,951 „	162,353 „
1848,	799,650 „	79,970 „	1856,	1,180,180 „	264,920 „
1849,	626,495 „	29,480 „	1857,	1,051,113 „	220,495 „
1850,	608,984 „	107,029 „	1858,	1,017,844 „	216,927 „
1851,	630,471 „	82,394 „			

Taking the average of the first four and the last four years of this period, we have—

	Linseed.	Rape-seed.
Average of the four years ending 1847,	554,848 qrs.	62,936 qrs.
„ „ „ 1858,	1,001,552 „	216,173 „ .

showing that the imports of linseed are now nearly twice, and of rape more than three times as great as they were at the commencement of the period. In estimating the quantity of oil-cake yielded by these seeds, it must be borne in mind that linseed is used for other purposes besides those of the oil-crusher; but the quantity diverted to these uses is not large, and I have ascertained from the best information at my disposal, that the linseed grown in this country, and of which no account is taken above, will be sufficient to cover all that is used for seed, in medicine, &c., leaving the whole of that imported, free for the manufacture of cake. At 53 lb. per bushel, which is rather a low average, 1,001,552 quarters of linseed must weigh 189,568 tons, which, allowing 25 per cent for loss of weight in the process, must yield 142,156 tons of cake, which, at the average price of £9 per ton, must be worth £1,279,404. Rape-seed usually weighs from 49 to 50 lb. per bushel, and at the latter weight, 216,173 quarters must weigh 38,660 tons, and yield 28,950 tons of cake, costing, at £5 per ton, £144,750.

The whole value of the oil-cake annually consumed in this country must therefore be as follows:—

85,952 tons imported oil-cake of all kinds, at £8, . . .	£687,616
142,156 „ home-made linseed cake, at £9, ...	1,279,404
28,950 „ „ rape-cake, at £5, ...	154,750
Total, ...	£2,111,770

It is to be observed that the prices here assumed are considerably under the average of those which the farmer would at present pay, good linseed cake ranging from £9, 10s. to £10, 10s, and

rape-cake from £5, 5s. to £5, 10s., but I have preferred to err on the safe side. I have also taken it for granted that the whole of the rape-cake, both imported and home-made, is used for feeding, which is not correct, because some of it is employed as a manure. The quantity consumed in this way cannot be ascertained, but it is not very large, and is probably counterbalanced by small quantities of cake made from other seeds, such as hemp, sunflower, &c., which are not included in the foregoing estimates.*

From these data it appears that the farmer is at the present moment spending nearly as much money on oil-cake as on guano. I find, in fact, that the average quantity of guano of all kinds imported into this country and retained for home consumption, during the four years ending 1858, has averaged 245,802 tons, and this at £11 per ton, which, considering the large quantities of inferior guano, is a fair estimate, is worth £2,703,822; but as it is well known that during these years the importations were greatly in excess of the demand, and stocks accumulated in this country, it is probable that the actual expenditure fell considerably short of this sum.

No facts are better calculated to impress upon us the importance of a proper knowledge of the composition and qualities of different kinds of oil-cake than these statistics, which show us that the farmer is every year depending more and more upon such substances for the manufacture of the beef and mutton we consume, and indirectly, of course, also, for the supply of manure for his crops. The interest attaching to it must be still further increased

* It may be interesting in this locality if I add the imports into Leith during the last ten years:—

1850,	4062 Tons.	1856,	6194 Tons.
1851,	5253 „	1857,	3889 „
1852,	4315 „	1858,	5654 „
1853,	5577 „	1859 (up till Dec. 12),	7107 „
1854,	5553 „		
1855,	5081 „	Average per year,	5268½ „

Importations of Linseed-Cakes and Rape-Cake into Leith during the last six years:—

	Linseed-Cake	Rape-Cake.
1854,	3358 Tons.	2195 Tons.
1855,	3410 „	1671 „
1856,	4230 „	1964 „
1857,	2353 „	1536 „
1858,	3697 „	1957 „
1859,	3901 „	3206 „
Average per year,	3491½ „	2088½ „

These numbers are interesting, because they show that the rape-cake imported into Leith bears a very high ratio to the linseed-cake, and that the farmers of this neighbourhood are fully alive to the advantages; and also because they indicate the effect which the short crop of this season has already had in increasing the imports, and that the quantity which will be used during this winter will be greatly above the average.

in a season like the present when the crop of turnips, straw, hay, and almost every other native cattle food is so greatly under the average, that all feeders, whatever their usual practice may be, will be forced to have recourse to some kind of imported food, among which oil-cake, which has been so long recognised as a safe and useful article, will no doubt obtain a preference.

It is not my intention on the present occasion to enter into any general disquisition on the economic uses of oil-cake, or to discuss the question on which so much difference of opinion exists among practical men, as to whether it is most profitable to depend on home-grown or purchased food; or whether, as has been maintained by some individuals, the latter is not a source of positive loss. I fully admit the importance of these questions, and though their discussion would bring out many points of interest, they are foreign to my present object. It must be observed, however, that on theoretical grounds their high nutritive value admits of no question, and the statistics just given must be taken as affording very strong evidence that theory and practice are at one on this point. The progress of agriculture during the last twenty years has forced the farmer to watch, much more carefully than he ever before did, the effects produced by all the articles, whether of food or manure, which he employs, and to attend more minutely to their economy; and it is inconceivable that, during the very time when accurate experiment has come to be almost a part of his business, he should have doubled his consumption of those kinds of food, if their use were actually unprofitable. The comparative profit derivable from oil-cake and home-grown food is a question of much greater nicety, and to which no general answer can be given, for it depends on an infinity of circumstances varying in every possible way, and producing opposite results in different cases. With these points, however, I have at present nothing to do. I am content with the fact, that a very large quantity of oil-cake is annually consumed, and my object is to point out to the farmer the nature of that article, the precautions to be adopted in its purchase, and to bring under his notice such kinds as are little known, and of which it might be advantageous to encourage the manufacture. I have at different periods published in the Transactions of the Highland Society many analyses of different kinds of linseed-cake, and of such rarer varieties as came under my notice, to which it will not be necessary for me to recur in detail. I have since obtained a considerable number of other kinds, some of them through the kindness of Professor John Wilson, who got a number of sample-cakes, which had been pressed at one mill from perfectly genuine seeds, and which are therefore valuable as standard specimens.

Linseed Oil-cake.—Linseed cake, which is the staple, and much more extensively consumed than any others, when of good quality,

differs but little in composition. The averages deduced from a large number of analyses is—

Water,	10.79
Oil,	12.47
Albuminous compounds,	28.53
Mucilage, sugar, &c.,	35.78
Fibre,	6.32
Ash,	6.11
	100.0
Nitrogen,	4.56

The ash contains—

Earthy phosphates,	2.92
Phosphoric acid combined with the alkalies,	0.88

Particular samples, of course, vary to some extent from this standard, but the difference is not very large, and chiefly affects the proportion of oil, which is generally rather lower in British-made cake, owing to the superiority of the machinery used in the oil-mills of this country. When the oil is low, it will in general be found that the albuminous compounds are above the average. In judging of the value of any cake, attention must be directed to the oil and albuminous substances in the first instance, but it is also important to observe that the fibre and ash should not be large. An excess of the former generally indicates the presence of some foreign matter, and of the latter, that the cake has been made from dirty seed, probably containing a quantity of sand, and in that case it is objectionable from its tendency to produce intestinal irritation in the animals fed on it. In estimating the value of any sample, however, it will not do to rely exclusively on the analysis, for instances occur in which a cake may have a composition but little different from the average, and yet be of inferior quality. A remarkable instance has lately come under my notice, in which a sample, giving the following results, was analysed :—

Water,	9.04
Oil,	9.30
Albuminous compounds,	27.75
Mucilage, sugar, &c.,	35.93
Fibre,	5.25
Ash,	12.73
	100.00
Nitrogen,	4.44

The ash contains—

Earthy phosphates,	1.99
	0.95
	7.06

On examining the sample, it was at once apparent that, notwithstanding these results, it was extremely impure, and contained a

large quantity of grass and other seeds, among which I detected some grains of what appeared to be blighted rye.

Owing to the general similarity in composition of many kinds of seed, it is perfectly possible that an oil-cake may be adulterated to a very considerable extent without its being apparent in the analysis, and hence it is necessary to submit the sample to a very careful examination before forming an opinion on this point.

The question of the adulteration of linseed-cake is considerably narrowed by an important commercial consideration. It yields an oil distinguished by its tendency to harden into a solid varnish, and hence called a drying oil; and it is impossible to adulterate this oil with any other without producing such a deterioration of its characteristic properties as to be immediately obvious. Hence linseed oil-cake is never adulterated with another kind of oil-seed; but when an admixture occurs, it is usually with some cheap non-oleaginous seed, and most generally with grass seeds. In the great majority of instances in which this occurs, the seeds have not been deliberately added as an adulteration, but are due to the careless cultivation of much of the linseed used abroad. It is difficult, of course, to form an opinion as to when inferiority due to dirty seed ceases, and positive adulteration begins; nor is the determination a matter of much importance in a practical point of view.

In judging, therefore, of the goodness of the cake, attention must be paid to its general appearance. It should be in hard well-pressed cakes, which show no tendency to split into layers. Its colours should be reddish, and, when broken across, its appearance should be uniform, and the smooth and glistening outer coat of the seed should be apparent. It should then be carefully examined for foreign seeds. Among these are frequently found small black seeds, which are hard, and have not been broken in the mill. These are often considered by the farmer to be injurious to the cattle; but it does not appear that this opinion is well founded, for they belong to various species of Polygonum, a genus which is not poisonous. They are objectionable, no doubt, because they are indigestible; and as they are so small that no difficulty would be experienced in separating them from the linseed, they are an indication of dirty seed; and where they are abundant, it is not uncommon to find the quantity of sand large.* Grass seeds, fragments of flax-straw, and of the capsule in which the seeds are contained, may all occasionally be observed, and, when they are abundant, should be noticed. As far as possible some judgment should be formed as to the proportion in which these substances are present; and as grass seeds resist to a considerable extent the crushing process, they may with patience be picked out in considerable quantity. Some of the cake should then be reduced to powder and mixed with cold water, when it ought to form a thick and firm paste; and if they be used in the proportion of one hundred

grains of cake to an ounce of water, the paste should be so stiff as to retain the form into which it is made. This character is of great importance, because almost every other seed which can be used as an adulterant diminishes the stiffness of the paste; and the only other substances which possess a sufficiently mucilaginous character are oily seeds, which cannot well be mixed with it. The general appearance of the paste—its peculiar colour and texture—are also characteristic. Of more strictly chemical tests there are few to be relied upon. One of the best is to mix a small quantity of the paste with a dilute solution of caustic potash; if the fluid acquires a yellow or green colour, something is wrong; but, on the other hand, adulterants may be used which fail to give any indication with potash.

While attention to these points will enable the observer, in many instances, to detect the inferiority of an oil-cake, it is no unfrequent occurrence to find specimens in which the eye detects nothing amiss, but which analysis shows to be inferior. Not long since I examined a sample which was particularly well pressed, was in remarkably neat cakes, and showed to the naked eye not the slightest appearance of foreign seeds, but analysis proved its composition to be as follows:—

Water,	10.81
Oil,	9.01
Albuminous compounds,	21.35
Mucilage, sugar, &c.,	39.96
Fibre,	9.36
Ash,	9.51
	100.00
Nitrogen,	3.41

The small proportion both of oil and albuminous compounds in this sample is remarkable, the latter being as much as seven per cent below the average. It was afterwards so far explained by information I received, that, at the mill where it was made, it was the practice to mix with the linseed a small quantity of bran or thirds, not as an adulteration, but because it had been found that the seeds pressed better, and gave a larger yield of oil. On examination with the microscope, I found that it did contain some granules of starch, apparently of wheat, but the quantity was not large, and I can scarcely imagine that this was the sole cause of the small proportion of albuminous compounds. Other instances of cakes of similar composition have come under my notice.

Rape-Cake.—The use of rape-cake for feeding has become very common in this country of late years, and bids fair to extend itself still further, as the results obtained from its use have been very favourable, where proper precautions have been taken. Its composition may be best judged of from the following analyses. No. 1

was made from German rape grown on the Eyder, and is one of the sample-cakes I owe to Professer. Wilson. No. 2 is described as best quality green rape-cake made expressly for feeding.

	I.	II
Water,	6.95	10.43
Oil,	8 63	12.50
Albuminous compounds,	29.75	27.68
Mucilage, sugar, &c.,	38 72	29.75
Fibre,	7.30	12 47
Ash,	8.65	7.17
	100.00	100.00
Nitrogen,	4.76	4.43

The ash contains—

Earthy phosphates,	2 93	2.32
Sand,	1.24	0.63

The composition of this cake does not differ materially from that of linseed. It differs from it, however, in its peculiar bitter taste, which is immediately distinguishable, and makes it at first less palatable to cattle. It is also more liable to adulteration, for the peculiarity of the oil, which restricts the number of adulterating substances that can be used with linseed, does not exist here, and other oleaginous seeds may be mixed with it without appreciable injury to the quality of the oil. On the other hand, the low price of the oil and cake prevents the use of all but the cheapest materials for this purpose.

Rape-cake of good quality is distinguished by its greenish colour, and by its more mottled appearance. When broken, the yellowish pieces of the inside of the seed, and the dark fragments of the outer coat, may often be very distinctly seen. When mixed with water in the proportion of a hundred grains to the ounce, it forms a semi-fluid paste, which runs like a thick fluid. The general colour is pale, studded with the dark-brown particles of the outer husk. Its smell is oleaginous. Caustic potash gives a strong green colour. These qualities vary considerably in different samples, and sometimes the general colour of the cake is brownish and very uniform, and a good deal appears to depend on the way in which the seed has been pressed; but when made into a paste with water, its appearance is very characteristic, and cannot well be confounded with that of other common cakes.

The chief adulteration of rape-cake is with mustard. It is probable, however, that the substance used is not the entire mustard-seed, but the dross obtained in preparing it for table use. This consists chiefly of the external coat of the seed, and hence is distinguished by a comparatively large proportion of fibre.

The two following analyses of cakes, made from brown and yellow mustard dross, will serve to illustrate their general composition.

	Brown.	Yellow.
Water,	8.44	8.76
Oil,	6.79	5.91
Albuminous compounds,	23.87	19.81
Mucilage, sugar, &c,	24.93	33.91
Fibre,	22.27	26 16
Ash,	13.70	5.45
	100.00	100.00
Nitrogen,	3.82	3.17

The ash contains—

Earthy phosphates,	1.68	1.90
Sand,	3.07	.64

It will be obvious that, though the proportions of the constituents of these substances differ considerably from those of rape-cake, there is nothing to prevent their being mixed with it to the extent of 10, 20, or even 30 per cent, without producing an effect on the analysis sufficient to attract attention. Nothing, however, is easier than to detect mustard in a cake; all that is necessary is to mix it with a sufficiency of cold water to form a soft paste, and leave it for some time, when the pungent smell of mustard will become more or less apparent. If the quantity is large, it can be detected almost immediately; but in all cases it is advisable to leave it for some hours, as the smell becomes more and more apparent, but after six or eight hours it begins to diminish again. Mustard-dross, when mixed with water, does not form a paste, but the particles sink to the bottom, and leave the water above with a more or less yellow colour. As it consists chiefly of the husk of the seed, it can be detected by the unusually large quantity seen in the paste formed by mixing the suspected rape-cake with water. It may also be distinguished by its microscopic characters, which are very different from those of rape.

Of late years, seeds have been imported into this country under the name of rape which belong to an entirely different plant. These are occasionally mixed with true rape, and sometimes substituted for it; and as their properties are highly deleterious, it is right that they should be guarded against; and bad effects have already occurred from their use. The seed in question is imported from the East Indies, and is commonly known as East Indian rape. Three different kinds at least have been imported—Calcutta rape, which is a small round seed not unlike the true rape, but more grey and less polished on the surface; Brown Guzerat rape is a somewhat larger seed, of a bright brown externally, and yellow inside; and Yellow Guzerat is a fine yellow colour both outside and inside. The confusion of these seeds with rape is an interesting illustration of the evil consequences resulting from the neglect of science on the part of commercial men. Had they consulted the botanist, they would have learned that these seeds could

not possibly be rape, because that plant is not a native of tropical climates, and that they must belong to some other genus. In fact, on examining the microscopic characters of the seed, I satisfied myself that it belongs to the genus Sinapis, which includes mustard and similar plants. The seeds are excessively pungent to the taste, and, when moistened with water, soon exhale the mustard smell.

An analysis of cake made from Calcutta rape gave—

Water,	7.93
Oil,	13.86
Albuminous compounds,	31.79
Mucilage, sugar, &c.,	20.26
Fibre,	12.59
Ash,	13.57
	100.00
Nitrogen,	5.09

The ash contains—

Earthy phosphates,	.54
Sand,	2.48

And its general resemblance to true rape-cake is very great, its colour being similar, and its appearance completely that of a good cake. It was not without interest that I noticed, a few months since, a case in the neighbourhood of Gloucester, in which an action was brought against the manufacturer of a rape-cake which had occasioned the death of some cattle. The cake was examined by Dr Voelcker, and declared to contain mustard. The manufacturer, in his defence, asserted that he had used East India rape, and I immediately recognised the seed, which I had ascertained to be a species of mustard. It is not at all improbable that similar cases have occurred before, and it is fortunate that we possess an easy and infallible method of detecting such impurities.

Poppy-Cake.—The manufacture of poppy-cake is carried on to a considerable extent on the Continent, and it is occasionally imported into this country, though not in any great quantity. The imports of the seed are also small. The sample cake which I examined was manufactured in this country; it contained—

Water,	6.56
Oil,	11.04
Albuminous compounds,	34.03
Mucilage, sugar, &c,	23.25
Fibre,	11.33
Ash,	13.79
	100.00
Nitrogen,	6.59

The ash contains—

Earthy phosphates,	5.28
Sand,	3.77

Poppy-cake has generally a pale greenish grey colour. Its cross fracture has a very uniform appearance, and its powder is nearly white. Its smell is somewhat oily, and its taste bland and pleasant; mixed with water, it forms a mucilaginous paste, less thick than that produced by linseed, and nearly white in colour. I am not aware that poppy-cake is adulterated. There is little inducement to mix it with other oily seeds, because it yields an oil of such quality that it may be used for cooking, and the admixture of any other renders it unfit for this purpose. As, moreover, the seeds are almost perfectly white, the colour of the cake would be so much altered by adulteration as immediately to attract attention. As a cattle food, poppy-cake holds a very high position; indeed, as a source of the flesh-forming constituents, it is superior to linseed-cake. It has been favourably spoken of by those who have made use of it, but I am not aware that the results of any precise experiments have been made public.

Rubsen Cake.—This cake, which is made from the seeds of the *Brassica præcox*, does not appear to be a frequent import into this country. It contained—

Water,	5.71
Oil,	11.00
Albuminous compounds,	26.87
Mucilage, sugar, &c.,	31.47
Fibre,	16.95
Ash,	8.00
	100.00
Nitrogen,	4.30

The ash contains—

Earthy phosphates,	2.76

This cake has a greenish colour and a very uniform appearance, both on the surface and in the interior. Its powder is pale greenish, and its taste agreeable, with the faintest possible degree of bitterness; with water, it forms a rather thin paste. It is distinguished from the preceding cakes by the larger proportion of fibre contained in it, by which the mucilage, &c. are proportionately diminished. In its other constituents it does not differ materially from linseed or rape.

Dodder.—The cake obtained from the seeds of the *Camelina sativa* has been frequently imported into this country in small quantities, but does not appear to have come much into use, partly, in all probability, because the supplies are limited. The composition of the sample cake was found to be:—

Water,	7.26
Oil,	7.99
Albuminous compounds,	29.00
Mucilage, sugar, &c.,	27.04
Fibre,	16.12
Ash,	12.59
	100.00
Nitrogen,	4.64

The ash contains—

Earthy phosphates,	1.81
Sand,	7.07

Dodder is very easily distinguished from any other variety of cake by its yellow colour, which is equally distinct on the surface and in the interior. Its taste is at first mucilaginous, but after a time a remarkably strong turnipy taste makes its appearance, which remains for some time on the tongue. With water, it forms a paste which is nearly as stiff as that produced by linseed, and gives off a strong turnipy smell. In point of composition, the cake calls for no special observation; its quality is good, and the only objection to it is the rather large proportion of sand in its ash, which, however, is unavoidable in so small a seed. It is probable that its strong taste may render it unsuited to feeding milch cattle, as it may affect the taste of the milk, but for stock it will be quite as useful as rape or even linseed.

Teel or Sesamum Cake—Several species of the genus Sesamum have been long cultivated as oil-plants in India, and their seeds have occasionally been imported into this country, and of late years to some extent. I have recently had an opportunity of examining two samples of this cake—No. I. I owe to Professor Wilson, No. II. was imported into Leith. Their analyses gave—

	I.	II.
Water,	1.56	10 38
Oil,	17.12	12.86
Albuminous compounds,	29.59	31.93
Mucilage, sugar, &c.,	17.01	21.92
Fibre,	21.15	9 06
Ash,	13.60	13.85
	100.00	100.00
Nitrogen,	4.73	5.11

The ash contains—

Phosphates (earthy),	2.03	5 00

The first of these samples had a reddish colour on the surface, and pieces of the white kernels of the seeds were here and there visible. In the cross fracture, the distinction between the outer coat and the interior of the seeds was particularly distinct. Its taste is

bland, but not mucilaginous, like that of linseed; mixed with water it becomes brown, and if they be in the proportion of 100 grains of cake to an ounce of water, the mixture is quite fluid, and the particles sink to the bottom, and occupy about two-thirds of the bulk, while the supernatant fluid has a dark colour. The Leith sample was very pale-coloured, and dull and dusty on the surface. Its fracture was light-coloured, and it was very soft and easily broken. Its taste was pleasant. The first sample was made from a very small species of Sesamum; the seeds being rather smaller than linseed, and their coats being thick, the large proportion of fibre becomes intelligible. Several of the species cultivated in India have seeds as large as a grain of wheat, and these would in all probability have yielded a still better cake. It is much to be desired that the importation of this seed should be encouraged. The great objection is the cost of carriage, and I understand that the importation of the cake is not profitable unless freights be very low.

Sunflower Cake.—The well-prepared sample of this cake was found to contain—

Water,	8.00
Oil,	8.94
Albuminous compounds,	21.68
Mucilage, sugar, &c.,	19.05
Fibre,	33.00
Ash,	9.33
	100.00
Nitrogen,	3.47

The ash contains—

Earthy phosphates,	3.54
Sand,	1.37

This cake is externally of a reddish-brown colour, and in the interior is very irregular, showing pretty large fragments of the outer coat of the seed. Its taste is faintly bitter, and it feels tough and woody between the teeth. Mixed with water, it does not form a paste, but separates from it on standing. Its quality, as will be seen from the analysis, is not high, and especially the large quantity (33 per cent) of woody fibre reduces its nutritive value very considerably below that of linseed or rape cake. At the same time, it is a cake which may be used with advantage, if it can be obtained at a low price.

Niger Cake.—About two years since I directed attention to this cake in the Transactions of the Highland Society, and published the only analysis of it I have yet seen. I was at that time unable to ascertain the seed from which it is prepared, but I have now learned that it is the *Guizotea Oleifera.* It is black, shining, and about a quarter of an inch in length, and very thin, with a rather

pleasant oleaginous taste. In the analysis of the cake, made two years since, I expressed a high opinion of its value, but remarked that a single analysis was not to be altogether relied upon. The subjoined analysis gives a somewhat lower value, although still sufficient to make it a useful cattle-food:—

Water,	6.23
Oil,	6.58
Albuminous compounds,	25.74
Mucilage, sugar, &c.,	42.18
Fibre,	11.15
Ash,	8.12
	100.00
Nitrogen,	4.10

The ash contains—

Phosphates (earthy),	2.98
Sand,	1.66

Hemp Cake.—The analysis of a sample of cake made from hemp-seed gave the following results:—

Water,	7.21
Oil,	7.90
Albuminous compounds,	21.47
Mucilage, sugar, &c.,	22.48
Fibre,	25.15
Ash,	15.79
	100.00
Nitrogen,	3.42

The ash contains—

Earthy phosphates,	3.50
Sand,	7.76

Hemp cake has a greenish colour, and is sure to be studded with shining fragments of the husk of the seed; and when broken, the distinction between the husk and yellowish kernel is very distinctly seen. Its taste is bland, but rather oily, and the husk feels rough and gritty under the teeth. Mixed with water, in the proportion of a hundred grains to the ounce, it does not form a paste, but sinks to the bottom of the glass, and only occupies about half the bulk of the fluid. The powder which it deposits is brown, and large fragments of the husk may be observed in it. The quantity of fibre contained in it is large, and the mucilage and other respiratory principles small; and, altogether, its quality must be looked upon as considerably under that of most varieties of cake.

Earth-nut Cake.—In the year 1855, I published two analyses of earth-nut cake. That which follows is of the sample cake supplied

me by Professor Wilson. It differs very considerably from either of the two previous samples, and is remarkable for the unusually large quantity of albuminous compounds contained in it:—

Water,	8.62
Oil,	8 86
Albuminous compounds,	44.00
Mucilage, sugar, &c.,	19.34
Fibre,	5.18
Ash,	14 05
	100.00
Nitrogen,	7.04

The ash contains—

Earthy phosphates,	.14
Sand,	13 47

The cake has a very pale-grey colour, rather reddish outside. Its cross fracture shows fragments of the kernel, and its powder is very light in colour. Its taste is bland and oily. It does not form a paste with water, and the particles fall to the bottom of the vessel, and leave a colourless fluid about one-fourth of the whole bulk. As a source of the flesh-forming elements, this cake would stand at the head of the list. It is only right, however, to observe, that it appears to be an exceptional sample, the previous analyses having shown only 26.71 and 33 85 per cent of albuminous compounds, and it seems probable that these are nearer the average. The sample cake had been made from the kernels of the nut, from which the outer shell had been very completely removed. It is possible that the previous samples may have contained the husk; but, as specimens have not been preserved, I am unable now to determine whether this is the case.

Pea-nut Cake.—Some time since a sample of cake was sent to the Laboratory under this name, but without any further information. I have failed to ascertain the name of the seed from which it is made, but I understand it is imported ready-made from America. It contained—

Water,	9.20
Oil,	7 62
Albuminous compounds,	22.25
Mucilage, gum, &c.,	30.25
Fibre,	26.97
Ash,	3.71
	100.00
Nitrogen,	3.56

The cake has a very coarse appearance, and is full of pieces of fibrous matter. Its taste is not disagreeable, and it does not form

a paste with water. It is not a cake of high quality, but, if moderate in price, may doubtless be used with advantage. It is probable, however, that this was an inferior sample. At least I learn from Mr Maclagan of Pumpherston, that a quantity of this cake, which he had some years since, did not agree in appearance with my sample, but was very uniform, and quite devoid of fibrous matter. He was well satisfied with the results of its use.

Cotton Cake.—It is not my intention to enter at present into any details regarding the composition of cotton cake, because it has been frequently discussed of late. I believe I was the first person to direct the attention of the farmer to its value as a feeding-stuff, by an analysis published nearly ten years since. Other analyses have since been made public by myself, and Professors Way and Voelcker, and the latter has recently produced an elaborate paper on the subject. It will be sufficient for me to point out that there are now two varieties in the market, the decorticated and the common. The former, which is the best, is distinguished by its uniform yellow colour; the latter is filled with large pieces of the dark-brown husk of the seed, which serve at once to distinguish it. This kind must be used with much caution, as bad effects have sometimes been observed. I believe, however, it may be used without risk, provided it be made from sea-island cotton-seed, the peculiarity of which is, that, when passed through the gin, the fibre of the cotton can be entirely removed from it, and the seed comes out perfectly clean. In all the other varieties a quantity of cotton sticks to the seed, and when this is made into cake without being decorticated, the cotton soon produces inflammatory symptoms in the animal which has fed on it, and death is the result. But when of good quality, and carefully used, it is a valuable addition to our list of feeding-stuffs, and its importation is now considerable.

Cress Cake.—A sample of this cake accompanied those sent me by Professor Wilson. It contained—

Water,	13.10
Oil,	7.68
Albuminous compounds,	20.25
Mucilage, sugar, &c,	35.44
Fibre,	10.87
Ash,	12.66
	100.00
Nitrogen,	3.24

The ash contains—

Earthy phosphates,	2.27
Sand,	3.14

The cake forms a thick paste with water, which exhales a very pleasant smell, exactly like that of new hay. Its taste is very pungent, and for this reason there seems little chance of its being

useful for feeding, although it might be employed with advantage as a manure.

I have thus pointed out the composition of a considerable number of substances which are well fitted for feeding stock, and some of them quite equal to linseed and rape cake. At the present moment their importation is trifling compared with those of the well-recognised varieties, and there is always a greater or less disinclination to use them so long as the others can be obtained. It is most desirable, however, that this should no longer exist, and that careful experiments should be made with every kind of cake imported, so as to ascertain how far actual experience corresponds with the results of analysis. I have myself no doubts on this point, but I am well aware that the confidence of the public will be increased by knowing that they have been successfully used. The facts I have stated at the outset are sufficient to show how much the farmer is interested in this matter, and in the question of the extent to which the high-priced linseed-cake can be replaced by other and cheaper substances. His interests in this respect are at one with those of the consumers of oils of all kinds, for of late years that commodity has greatly increased in price, and the discovery and importation of cheap oil-seeds is a matter of much economic importance. At present, we rely almost entirely on the oil-plants of Europe, but large and important supplies might be obtained from warm climates, and their importation would be greatly encouraged if there is a probability of a fair price being obtained for the cake they yield. The extent to which this must operate will be obvious, when it is known that a ton of linseed costs from £15 to £17, and a ton of the cake it yields from £9 to £10, 10s. The importation of the earth-nut chiefly from the coast of Africa, and of teel from India, are instances of imports which might be greatly extended; and there are doubtless many other tropical oil-seeds which might be imported into this country. The cultivation of such plants is well worthy the attention of those interested in developing the resources of some of our colonies, and especially of India, for there is no doubt that they would meet with a ready market at moderate prices. In fact, the consumption of oil might be increased to a great extent by a reduction of price, and the use of mineral oils, which has sprung up within the last seven or eight years, is the best proof that the supply of vegetable oils is insufficient to meet the demand; and anything which retards their use, restricts the supply of cattle-food available for the farm.

During the present season, the use of oil-cake derives additional importance from the short crops of ordinary cattle-food, and the circumstances under which it will be employed will probably render some deviation from the usual practice necessary. In general, oil-cake is used as a supplementary food, and for the purpose of obtaining a larger amount of nutriment within a given bulk. The

quantity of the bulky foods, such as the turnip and straw, which an animal will consume, is not dependent on the quantity of nutritive matters they contain, but upon the capability of the stomach to contain them; and an animal ceases to feed, not because it has taken in all the nutritive matters it is capable of consuming, but because the sense of repletion causes it to stop. We increase the rapidity of the fattening process by giving the animal a more concentrated food, which enables it to consume a larger quantity of nutritive matter without producing the same sense of repletion. On the other hand, if the bulk of the food be too much reduced, the animal will go on feeding till the stomach is filled to the extent necessary for the proper performance of the function of digestion, and there may thus be a serious waste of nutritive matters. Under ordinary circumstances, where the oil-cake constitutes a limited and comparatively small part of the food, this is rarely if ever observed; but when, as will in all probability be the case this season, the quantity given to the animals will be larger, there is more danger of its occurring; and it will be well that it should be borne in mind that, under such circumstances, it may be advisable to add to the bulk of the cake. This can be easily done by making it up into a mucilage or paste with five or six times its weight of water.

I have only to add, in conclusion, that though I have analysed all the cakes I have been able to obtain, there may be many varieties which have not come under my notice; and as I am anxious to make my examination as complete as possible, I shall esteem it a favour if any one who happens to see rare and hitherto unanalysed cakes will send samples to the Laboratory. For this purpose, three entire cakes of each kind will be useful, so that a specimen may be preserved for the Society's Museum; and their value would be still further increased if accompanied by specimens of the seeds and oil; a couple of pounds of the former, and a quart of the latter, being sufficient quantities.

ABSTRACT of the ACCOUNTS of the HIGHLAND and

(The detailed Accounts will be submitted, in terms

CHARGE.

1.	Balance in the Royal Bank of Scotland at 30th Nov. 1858,			£1333 9 11
2	Medals on hand at do.,			33 18 6
3.	Arrears of Subscriptions at do.,		£336 9 0	
	Less written off as irrecoverable,	£85 11 6		
	Extinguished by Life Compositions,	57 4 6		
			142 16 0	
				193 13 0
4.	Interest on £14,500 Heritable Securities,		£586 1 4	
5.	Dividends on £16,243, 10s. 11d. Bank Stock,*		664 1 11	
6.	Dividends on £3570 Debentures,		193 6 5	
7.	Dividend from British Fishery Society,		20 0 0	
8.	Progressive Interest on Bank Account,		17 7 5	
				1,480 17 1
9.	Annual Subscriptions,			890 17 6
10.	Life Subscriptions,			953 6 6
11.	Subscriptions in aid of Local Competitions,			79 10 0
12.	Chemical Department—			
	1. Balance in Royal Bank at 30th Nov. 1858,		£107 14 1	
	2. Annual Subscriptions,		167 17 6	
	3. Sub-rent of Laboratory,		33 6 8	
	4. Progressive Interest on Bank Account,		0 17 11	
				309 16 2
13.	Aberdeen Show, 1858—Receipts per Abstract,			2,609 10 7
				£7884 19 3

* Selling Price at 30th November 1859.

Note.—The Funds and Property of the Society at 30th November consisted of—

Investments,	£34,413 10 11
Balance in Bank,	1,412 10 1
House Property in Albyn Place and George IV. Bridge, valued at	7,487 18 5
	£43,313 19 5

AGRICULTURAL SOCIETY of SCOTLAND, for the Year 1858-9.

of the Charter, to the General Meeting on 18th January 1860.)

DISCHARGE.

1. Establishment Expenses—						
1. Secretary's Salary,	£500	0	0			
2. Allowance for Heating, Cleaning, Service, &c.,	83	5	0			
3. Auditor's Fee,	30	0	0			
4. Clerks' Salaries,	163	18	0			
5. Allowance to Curator of Machinery,	10	0	0			
6. Feu-duty, Taxes, Repairs, &c., Albyn Place,	133	10	5			
				£920	13	5
2. Chemical Department—						
1. Chemist's Salary,	£300	0	0			
2. Rent of Laboratory,	56	3	0			
3. Balance in Royal Bank, 30th Nov. 1859,	49	16	2			
				405	19	2
3. Veterinary Department—						
1. Allowance to Professor Dick,	£26	5	0			
2. Medals to Students,	6	8	0			
3. Advertising,	4	17	0			
				37	10	0
4. Museum—						
1. Messrs Lawson in full for Collection,	150	0	0			
2. Feu-duty, Taxes, Repairs, &c.,	136	16	0			
3. Heating, Cleaning, &c.,	12	15	1			
4. Porter's Wages and Livery,	26	16	6			
5. Incidental Expenses,	1	5	0			
				327	12	7
5. Premiums—						
1. Premiums outstanding of 1857,	£77	6	0			
2. Premiums for Reports,	151	2	0			
3. Premiums—Aberdeen Show,	1241	12	0			
4. Premiums—Local Competitions,	603	10	0			
				2073	10	0
6 Printing,				119	16	4
7. Stationery,				21	0	0
8. Advertising,				42	3	11
9. Postages and Carriages,				55	4	5
10. Miscellaneous Expenditure—						
1. Travelling Expenses,	£9	10	0			
2. Do. for Committee on General Shows,	23	15	6			
3. Dynamometer	26	10	0			
4. Examination for Agricultural Diploma,	30	1	6			
5. Bank Charges and Stamps,	5	2	9			
6. General Meetings—Hire of Hall, Reporting, &c.,	17	15	0			
7. Glasgow Show, 1857—Balance of General Expenses,	10	5	6			
8. Messrs Lawson for Turnip Seed,	3	12	0			
9. Meteorological Society Subscription,	5	0	0			
10. Incidental Expenses,	6	4	4			
				137	16	7
11. Aberdeen Show, 1858,—General Expenses per Abstract,				1558	9	3
12. Amount carried to permanent fund, and invested,				450	0	0
13. Balance on Bank Account at 30th Nov. 1859,				1412	10	1
14. Medals on hand at Do.,				81	18	6
15. Arrears of Subscriptions at Do.,				290	15	0
				£7884	19	3

EDINBURGH, 21*st December* 1859.

Signed, in terms of the Charter, by

ANTHONY MURRAY, *Convener of Finance Committee.*
ROBERT G. BAILLIE, *Member of Finance Committee.*
ARCHD. HORNE, *Auditor.*

ABSTRACT of the ACCOUNTS of the HIGHLAND and

(The detailed Accounts will be submitted, in terms

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	Less written off as irrecoverable,	£85 11 6		
	Extinguished by Life Compositions,	57 4 6		
			142 16 0	
				193 13 0
4.	Interest on £14,500 Heritable Securities,		£586 1 4	
5.	Dividends on £16,243, 10s. 11d. Bank Stock,*		664 1 11	
6.	Dividends on £3570 Debentures,		193 6 5	
7.	Dividend from British Fishery Society,		20 0 0	
8.	Progressive Interest on Bank Account,		17 7 5	
				1,480 17 1
9.	Annual Subscriptions,			890 17 6
10.	Life Subscriptions,			953 6 6
11.	Subscriptions in aid of Local Competitions,			79 10 0
12.	Chemical Department—			
	1. Balance in Royal Bank at 30th Nov. 1858,		£107 14 1	
	2. Annual Subscriptions,		167 17 6	
	3. Sub-rent of Laboratory,		33 6 8	
	4. Progressive Interest on Bank Account,		0 17 11	
				309 16 2
13.	Aberdeen Show, 1858—Receipts per Abstract,			2,609 10 7
				£7884 19 3

* Selling Price at 30th November 1859.

Note.—The Funds and Property of the Society at 30th November consisted of—

Investments,	£34,413 10 11
Balance in Bank,	1,412 10 1
House Property in Albyn Place and George IV. Bridge, valued at	7,487 18 5
	£43,313 19 5

AGRICULTURAL SOCIETY of SCOTLAND, for the Year 1858-9.

of the Charter, to the General Meeting on 18th January 1860.)

DISCHARGE.

1. Establishment Expenses—						
1. Secretary's Salary,	£500	0	0			
2. Allowance for Heating, Cleaning, Service, &c,	83	5	0			
3. Auditor's Fee,	30	0	0			
4 Clerks' Salaries,	163	18	0			
5. Allowance to Curator of Machinery,	10	0	0			
6. Feu-duty, Taxes, Repairs, &c., Albyn Place,	133	10	5			
				£920	13	5
2. Chemical Department—						
1. Chemist's Salary,	£300	0	0			
2. Rent of Laboratory,	56	3	0			
3. Balance in Royal Bank, 30th Nov. 1859,	49	16	2			
				405	19	2
3. Veterinary Department—						
1. Allowance to Professor Dick,	£26	5	0			
2. Medals to Students,	6	8	0			
3. Advertising,	4	17	0			
				37	10	0
4. Museum—						
1. Messrs Lawson in full for Collection,	150	0	0			
2. Feu-duty, Taxes, Repairs, &c.,	136	16	0			
3. Heating, Cleaning, &c.,	12	15	1			
4. Porter's Wages and Livery,	26	16	6			
5. Incidental Expenses,	1	5	0			
				327	12	7
5. Premiums—						
1. Premiums outstanding of 1857,	£77	6	0			
2. Premiums for Reports,	151	2	0			
3. Premiums—Aberdeen Show,	1241	12	0			
4. Premiums—Local Competitions,	603	10	0			
				2073	10	0
6 Printing,				119	16	4
7. Stationery,				21	0	0
8. Advertising,				42	3	11
9. Postages and Carriages,				55	4	5
10. Miscellaneous Expenditure—						
1. Travelling Expenses,	£9	10	0			
2. Do. for Committee on General Shows,	23	15	6			
3. Dynamometer	26	10	0			
4. Examination for Agricultural Diploma,	30	1	6			
5. Bank Charges and Stamps,	5	2	9			
6. General Meetings—Hire of Hall, Reporting, &c.,	17	15	0			
7. Glasgow Show, 1857—Balance of General Expenses,	10	5	6			
8. Messrs Lawson for Turnip Seed,	3	12	0			
9. Meteorological Society Subscription,	5	0	0			
10. Incidental Expenses,	6	4	4			
				137	16	7
11. Aberdeen Show, 1858,—General Expenses per Abstract,				1558	9	3
12. Amount carried to permanent fund, and invested,				450	0	0
13. Balance on Bank Account at 30th Nov. 1859,				1412	10	1
14. Medals on hand at Do.,				81	18	6
15. Arrears of Subscriptions at Do.,				290	15	0
				£7884	19	3

EDINBURGH, 21*st December* 1859.

Signed, in terms of the Charter, by

ANTHONY MURRAY, *Convener of Finance Committee.*
ROBERT G. BAILLIE, *Member of Finance Committee.*
ARCHD. HORNE, *Auditor.*

Aberdeen Show, 1858.—Abstract of Accounts.

(The detailed Accounts will be submitted

Charge.

1. Local Subscriptions—						
1. Contribution by Aberdeenshire,				£449	1	8
2. Contribution by Banffshire,				116	11	6
3. Contribution by Kincardineshire,				137	6	6
4. Contribution by Eastern District of Forfarshire,				147	8	4
5. Contribution by Corporation of Aberdeen,				75	0	0
6. Contributions by Inhabitants of Aberdeen,				54	11	0
7. Contribution by the Royal Northern Society,				100	0	0
8. Contributions by Local Societies and Tenant Farmers,				17	5	6
				£1097	4	6
2. Entry-Money—						
1. On Stock,	£40	16	6			
2. On Implements,	42	8	6			
				83	5	0
3. Amount collected during Show—						
1. Drawn at Show-Yard gates,	£1023	12	11			
2. Drawn at Trial of Implements,	53	2	11			
3. Catalogues and Lists of Awards sold,	152	19	6			
4. Rent of Refreshment-Booth,	40	0	0			
5. Payments for Cattle Accommodation and Food,	87	19	6			
6. Society's proportion of 284 Dinner Tickets sold,	60	1	0			
7. Interest from Banks,	11	5	3			
				1429	1	1
				2609	10	7
4. Balance,				190	10	8
				£2800	1	3

Aberdeen Show, 1858—Abstract of Accounts.

to the General Meeting on 18th January 1860.)

Discharge.

1. Premiums drawn at 30th November 1859,			£1241 12 0
2. Contractor for fitting up Show-Yard, .		£614 0 0	
3. Food for Cattle, ...		30 5 7	
4. Water Supply, ...		11 1 10	
5. Police Force, ...		10 4 9	
6. Assistants, Porters, and Labourers, .		41 6 8	
7. Travelling Expenses of Judges, Staff, Clerks, &c.		97 12 5	
8. Hotel Bills for Judges, Staff, Clerks, &c,		160 15 1	
9. Refreshments in Show-Yard, . .		28 1 0	
10. Banquet—			
1. Hire of Pavilion, ...	£120 14 4		
2. Lights and Fittings, . .	36 0 5		
3. Tickets for Judges, Staff, &c, .	33 1 6		
4. Music, Engraving Tickets, and Advertising, ...	13 11 0		
		203 7 3	
11. Printing—			
1. Catalogues, ...	£95 0 0		
2. List of Awards, ...	13 16 6		
3. Bills and Placards, . .	21 13 6		
4. Certificates, Subscription Papers, Circulars, &c., . . .	41 17 6		
		172 7 6	
12. Advertising—			
1. At Railway Stations, . .	£29 4 0		
2. In Newspapers, ...	34 17 7		
		64 1 7	
13. Trial of Implements—			
1. Damage to Crops and Preparing Ground, ...	£13 8 0		
2. Cartage of Implements, and for Coals,	15 1 9		
		28 9 9	
14. Allowance to Local Secretaries, ...		21 0 0	
15. Postage and Business Accounts by same, . .		10 18 10	
16. Postages in Office, ...		18 10 0	
17. Clerks, ...		20 0 0	
18. Local Collectors' Commission on County Subscriptions,		21 0 9	
19. Stationery, and Miscellaneous Expenditure, . .		5 6 3	
			1558 9 3
			£2800 1 3

Edinburgh, 21*st December* 1859.

ARCH[D]. HORNE, *Auditor.*

ABSTRACT OF THE ACCOUNTS OF THE ARGYLL NAVAL FUND FOR 1859.

CHARGE.

	£	s.	d.
1. Balance in the Royal Bank of Scotland at 30th November 1858, . .	£635	11	9
2. Interest on £3000 Heritable Security,	115	10	0
3. Dividend on £1200 Debenture, .	46	4	0
4 Dividend on £500 Debenture from Whitsunday to Martinmas, . .	9	10	5
5. Progressive Interest on Bank Account,	6	6	9
	£813	2	11

DISCHARGE.

	£	s.	d.
1 Allowance to Three Recipients, at £40 each, ...	£120	0	0
2 Sum drawn from Bank and invested on Debenture, ...	500	0	0
3. Balance in Royal Bank at 30th November 1859, ...	193	2	11
	£813	2	11

ON THE CULTIVATION OF MANGOLD-WURZEL IN SCOTLAND.

By Robert Scot Skirving, Camptown, East-Lothian.

[Premium—The Gold Medal.]

"*There* is a crop to which I have a peculiar dislike!" Such was a remark made to me by a successful practical agriculturist, pointing from a railway-carriage to a field of mangold. On asking why anything so apparently inoffensive as a mangold-wurzel could excite his aversion, I found he had never grown the crop, but, looking upon the root as an interloper, he regarded it with that distrust which innovations usually excite—a distrust which, after all, may perhaps be productive of quite as much benefit as injury.

Considering that the mangold has been so long and so largely cultivated in England, and that there its agricultural value is so universally admitted, it appears strange that its progress in Scotland has not been more rapid. The whole ground devoted to it, as shown by the Statistical Report for 1854, the first year the returns were collected, was only 1946¾ acres; and in 1857, when they were brought to a close, it had only increased to 2803½ acres. It is significant of the purpose for which the root is chiefly grown, that upwards of a third of the whole of this acreage is returned by the milk-producing county of Ayrshire.

That there is nothing in the soil or climate of many districts in Scotland to hinder the plant being profitably cultivated, experiments have abundantly testified; and all who have in autumn secured a good crop, must have become in spring fully convinced of its utility. It is true that the turnip will flourish where the mangold cannot be grown, and that in the higher districts, where the soil is less deep and the climate less genial, it cannot be cultivated to advantage; but on most of the wheat and bean producing land of Scotland it might undoubtedly form a very beneficial auxiliary to the turnip crop. Two objections are frequently urged as reasons for not cultivating mangolds. It is said they are troublesome and expensive—that they are difficult to sow, require frequent tending, consume much manure; and that a considerable portion of the crop is lost from the plants running prematurely to seed. Having cultivated mangold to some extent during the last eight years, I have become convinced that these objections are greatly overrated.

On first growing the crop, I shared with many in the idea that some peculiar difficulty attended the operation of sowing. Re-

course was had to the hand, and the seed was sometimes dibbled, and sometimes strewn along the drill. Had any such laborious practice been necessary, it would alone have been sufficient to prevent the root being ever extensively grown. I shall endeavour to give the results of my experience. It is obvious that a vegetable striking its roots so deep in the earth as the mangold, requires an abundant mould; but this being obtained, it grows freely in soils of very various descriptions, ranging from clay to sand. With regard to the previous preparation of the ground, the treatment necessary to secure a crop is exactly similar to that required for Swedish turnips, though perhaps the farmer should be still more anxious to obtain a fine mould, and the mangold will endure, if not absolutely require, a still larger amount of manure. I need not say that autumnal manuring and early ploughing tend largely to secure the necessary fitness and friability. I have been in the habit of applying some fifteen cart-loads of farmyard dung before ploughing the stubble in autumn; and I have sometimes added, say five more when the seed was sown, together with about 4 cwt. per acre of mixed portable manures. To these applications I last season added 4 cwt. of agricultural salt, and to one portion a corresponding value of Glauber salt (sulphate of soda); but, probably from the comparative proximity of the field to the sea, no difference could be noted between the portions thus treated and a space left without salt. Of the three varieties of mangold in common use—viz., the red globe, the long red, and the orange globe—I am inclined to give the preference to the latter. It is possible that, in very deep soils, the long red may produce the heaviest crop; but while the yellow variety demands, from its shape, less depth of mould, it is also better defended by leaves, and consequently suffers less from frosts at night; and these, by checking the growth of the plant, are, I imagine, a chief cause of early seeding. These frosty nights necessitate a comparatively late period of sowing.* The chief secret of the great weight of roots obtained in England, and the prodigious size of bulb and weight of produce per acre reached in France, is the long period the plant is permitted by the climate to occupy the soil.† Early sowing in Scot-

* The greater liability of mangold to run to flower in Scotland is a curious and interesting subject. The eastern counties of England, where it thrives so well, are almost as liable to frosts during the night as the lowlands of Scotland. Perhaps the lower day temperature in the North may have a good deal to do in promoting flowering, by lessening the vitality of the plants. Deep cultivation and liberal manuring seem to be the most effectual means of counteracting this tendency.—ED.

† The roots shown at Smithfield in 1857 ranged from 30 to 36 lb., whilst in the south of France, where the white mangold may be sown at New Year, and raised at the end of November, thus having eleven months to grow, the produce is sometimes quite enormous. M. Auguste de Gasparin, as well as his brother, Count de Gasparin, the distinguished agriculturist, vouch for the fact that they have repeatedly seen crops which *averaged* from 30 to 37 lb. per root, reaching, in one case, a total yield of 156 tons per acre, one root weighing 182 lb.

land would certainly make a larger crop possible; but few seasons are so mild as to allow the plants to escape.

I would not, therefore, recommend sowing earlier than the 25th of April, nor later than the 4th of May. These ten days are, I consider, the best seed-time for Scotland. I cannot wish any implement better adapted for sowing mangold than the common turnip-drill machine. All that is necessary is, to remove the tin drums or boxes which hold the seed, and replace them with similar ones, pierced with larger holes. After trying orifices of various sizes, I found that those measuring three-eighths of an inch in diameter were best adapted for the purpose. The quantity of seed used per acre is about 6 lb., costing 9d. per lb.* It is therefore evident that this part of the operation does not offer much scope for economising. The value of the seed saved would be less than that of the labour of saving it, whilst the regularity of the "braird" might be endangered. After repeated trials of steeped seed, I could not see that the practice had anything to recommend it. In sowing mangold, care should be taken that the seed be buried only to a very small extent; the slightest covering of mould is sufficient; and unless the soil be absolutely dry, the light wooden rollers which are generally attached to the sowing-machine should be removed. By neglecting this I found that the vegetation of the seed was, on one occasion, entirely prevented. The land having been prepared and worked as for a crop of swedes, the drills are also formed in the same manner, 28 inches from centre to centre, and, subsequently to sowing, are cleaned by the horse-hoe, &c., as in the case of the turnip crop. With regard to the period of thinning, this must of course be regulated by the growth of the plants. As soon as these begin to crowd each other, they ought to be reduced in number. This I have generally done by having them roughly gone over with the hoe, spaces of about a foot being "slapped" out of the drill, leaving two or three plants together. Some time after this—but the exact period being again regulated by the growth of the plants, which will vary with the weather—they should be singled with the hand, the best roots selected, and left at distances of 16 inches apart. During summer the roots that threaten to run to seed may be cut over, when, though inferior to the rest, they are not lost, but to some extent continue to grow. I have seen it recommended that the stalks of these plants should be twisted off with the hand, and not cut with a

* Premiums were awarded at Edinburgh in August last for two excellent machines for sowing mangold on the dibbling or drop principle. Many prefer the dibbling, as the plants can be set out at more regular distances than when the seed has been sown in a continuous stream. We met with some parties on the show-ground who had purchased these machines for sowing turnips in the same way, owing to the practical difficulty experienced in having turnips thinned out at regular intervals. —Ed.

knife; but as this is almost certain to loosen the root, cutting is the better mode of the two. Could the seeding plants be removed and given to pigs, it might be the most profitable way to dispose of them; but as this would necessitate the use of carts in the field, the damage done to the good roots would more than overbalance the gain. On no account should leaves be stripped off. The plants thus mutilated never attain perfection, and lose, moreover, the protection with which nature has provided them. Endeavouring to prevent premature seeding, I have tried the effect of using seed two or three years old; and though I cannot say the superiority over one year's seed was ever very marked, I incline, perhaps from prejudice, towards the older growths. When not too early sown, the loss from seeding or "shooting" is, after all, more apparent than real, particularly when the stalks have been cut over before getting hard and dry.

The proper period for storing mangold is fixed by our climate pretty distinctly. They ought to be in the ground as long as they are secure from frost, and not a day longer. Having lost the whole crop in 1856 from an unexpected frost which set in on the 26th of November, I have since then thought it prudent to forego any additional growth which might be obtained by delay, and make it a point that the roots should be stored before Martinmas. The *first week of November* may be named as the latest period to which storing can with prudence be delayed.

I have said that to grow mangolds they should be managed very much like turnips; to store them, they should be treated like potatoes. Having removed the tops, but left the roots uncut, they should be at once carried to the "pits." These may be of larger size than those usually made for potatoes, but, like them, they should receive a covering of earth as well as straw. No doubt, in winters such as that which has just passed, straw alone would be amply sufficient; but, on the other hand, frost such as we experienced in 1855 would have reached and destroyed them had straw alone been used. The additional expense, therefore, of covering mangolds with earth, must be regarded as an insurance against the ravages of intense frost. Properly secured, mangolds keep fresh and juicy for a great length of time. A person who had grown them in England told me he had used them at Christmas, fourteen months after taking them up. I have myself kept them, though only on an experimental scale, till September; and have seen sheep eat them in summer in preference to excellent grass. It must be observed at the same time, that they cannot be made use of with advantage till after being some months in store. Too early used, they are laxative, and produce scouring in both cattle and sheep. To determine the comparative value of the mangold for feeding purposes, would necessitate experiments in which its merits should be tested with those of other roots. These I have

not undertaken, but I am inclined to believe that its fattening properties are inferior to those of Swedish turnips. It is to provide food for ewes and lambs in spring that I have chiefly grown the mangold, and there can be no doubt that its lactific properties are pre-eminent. I have been practically convinced that a change from turnips to mangold in feeding sheep will very largely increase the quantity of their milk, causing some ewes to become good nurses which were before scarce able to support a lamb. The shepherd, however, while rejoicing in the increase of the milk, complains that it is not rich, and that lambs do not grow fat upon it. Though entertaining some suspicion that shepherds are very apt to find pretences for indulging their flocks in corn, or cake, or hay, I believe that this charge against the mangold is well founded; and if it is wished that lambs should be early fattened, the flock should be supplied with some addition to the root diet. I have lately observed that the author of a publication on the sheep, alleges that when ewes are fed for a length of time upon mangold only, it causes the wool to come off in flakes. Having for several years given a large flock nothing but mangold for months continuously, I am satisfied that this statement is erroneous. One per cent perhaps of the sheep may have lost wool, but this happens to as great an extent however the animals be fed.

Mangolds are, to some extent, more expensive than turnips. They demand good soil, they require a very liberal share of manure, and they cost a little more labour in singling and in storing. On the other hand, they have proved, in my experience, a more certain crop, and they are much less exposed to disease, or to the ravages of insects. For eight consecutive seasons there has been no failure in the crop, which has been raised from soils of various descriptions, chiefly loam, but sometimes embracing clay, and ground containing sand or moss. The produce I estimate as averaging about 25 tons per imperial acre. On two occasions the amount was carefully ascertained, and found to be in the one instance 25 tons 4 cwt. per imperial acre, in the other to 26 tons 8 cwt. During the same period the turnip crop has had to contend, not always successfully, against some diseases, and many insect enemies. Besides these considerations, in estimating the cost of raising mangold, the effect upon succeeding crops must not be forgotten. Its early removal from the ground allows wheat to be sown with the greatest advantage, whilst its ample store of leaves (if not used for cows) enriches the soil, and the large quantity of manure makes itself felt by more than one succeeding crop.

Finally, the mangold must be viewed as a supplement, and not as a rival to the turnip. If it demands extra expense and special care, it is required for a special purpose—viz., to supply food and milk at a period when these are most needed; at a time—

"When nights are chill, and clouds are grey,
A month before, and the month of May,
When the spring comes slowly up the way."

April 1859.

P.S.—Jan. 1860.—An opportunity being afforded, some notes regarding the mangold crop of last year may be added to the above.

The season of 1859 will long be remembered as being, with the exception of that of 1826, the dryest experienced in East Lothian during recent times. Partly from the effects of this great drought, but still more from other and less obvious causes, the turnip crop throughout the whole district alluded to in this paper has been either a total or a partial failure. It would be out of place here to enter into any examination of the nature and causes of a disease which has swept away two-thirds of our most largely cultivated root-crop, but we may briefly state the appearance of the turnip and the mangold during a season which has produced such remarkable results.

When the period for sowing the root crop arrived, the ground was already almost absolutely dry, but the mould was fine, and the seed was committed to the soil in the hope that rain would shortly follow. The drought, however, continued unbroken till the 22d of June, when, a sufficient quantity of rain having fallen, all the seeds vegetated freely, and at the period of singling, nothing could be more luxuriant than most of the turnip-fields; swedes, with the exception of one limited district, continued free of disease, and their lateness only was the cause of their being so poor a crop as they proved. They are, however, less vigorous than usual, and the roots are keeping very badly, both in the store and in the field. Very different has been the fate of the softer varieties of turnips. No sooner did they reach the stage at which they began to cover the ground with their leaves, than they suddenly assumed a blighted, or rather a *scorched* appearance. The leaves became yellow and withered; caterpillars attacked the already diseased root; the whole plant decayed, shrunk up, and in many cases utterly disappeared. The mangolds, on the contrary, have been entirely free of disease, and though only a few scattered seeds vegetated before the rain, the crop has exceeded the most sanguine expectations that could have been formed of it during summer. The best crops were those which were sown early, before the soil had lost its moisture; but in ordinary seasons, we see no reason to doubt that the advantage would have been the other way. Prizes are annually offered by the local agricultural society for the best acres of mangold, and of the various descriptions of turnips. This season the latter brought out no competitors from the district already alluded to, whilst there was an unusually large competition for the mangold premium. The crops were generally excellent—

the highest weights being 48 tons, 13 cwt., 42 tons 6 cwt., and 39 tons 3 cwt. per *Scotch* acre. When we remember the untoward nature of the season, and the failure of the turnip crop, these carefully ascertained weights are a sufficient proof of the value of the mangold to the Scottish agriculturist.

As regards the individual experience of the writer, the result of crop 1859 may be thus stated:—Of a field of 25 acres, 20 were sown with mangold—the remainder with purple-top turnips. So long were the mangold of *brairding*, that the crop was despaired of, and half of it unfortunately ploughed down and sown with white-globe turnips. Both varieties of turnips were luxuriant when singled, and both shrunk up, withered, and, with the exception of an occasional root, absolutely disappeared. The mangold, though very blanky, were a healthy, vigorous, and by no means a contemptible crop, and are now as fresh and sound as when removed from the field.*

REPORT ON THE MANAGEMENT OF SHEEP, IN BREEDING, FEEDING, AND DISEASE.

By JAMES B. BIRD, Renton Barns, Berwickshire.

[Premium—The Gold Medal.]

THAT the breeding of sheep alone, or the breeding and feeding of them combined, where soil, situation, and rent are suitable, is one of the most profitable departments of farming, has long been the experience of the most of upland farmers. Such also is the opinion that seems to be spreading rapidly now, even amongst numbers in the lower districts, who, while wheat continued to realise the very remunerating price of £3 or £4 sterling per quarter, and barley and oats proportionably high, never for a moment, perhaps, gave one serious thought as to the possibility of breeding sheep at a profit on their first-class high-rented land; choosing rather to buy them from those who could breed more easily, at a price which, considering the heavy expense incurred in producing a fair crop of turnips, as well as the great mortality amongst the sheep themselves, in some seasons left anything but a remunerating sum to encourage the feeding of them as a lucrative

* The following may be noted in reference to the remarks that, in some situations at least, salt may be more easily overdone as a mangold manure than is generally supposed. In addition to the other manure, 10 drills were sown with salt, at the rate of about 6 bushels per acre, and the result was, that the seed did not vegetate at all.

transaction; very probably often a loss, expected to be repaid by the succeeding white crop; but who, now when good quality of wheat brings only about £2 sterling per quarter, while mutton in the wool is at 8d. per pound, and wool itself at 30s. to 40s. per stone, begin to think, with reason, that even with heavy lands something may be done in the way of the breeding and the feeding of sheep combined. Rents must be paid; grain at present prices cannot do so; and not a few who some years ago kept not one ewe, now, as a matter of necessity, turn their attention to breeding. That such may be done successfully and profitably on many a farm, on which, at no very distant date, the bare idea would have been regarded as the height of folly, but which now, through drainage, followed by heavy limings, having not only made a very great alteration in their general aspect, but a materially beneficial change in their very nature, there seems every reason to expect. And yet the possibility exists that such expectation may practically meet with disappointment. For although, in the breeding, rearing, and feeding of sheep successfully and profitably, much, *very much*, is due to good and efficient management, which can only be gained by experience, as well as the natural inclination and taste for it; still, on the other hand, as well known to every one, certain soils and situations are by nature much more adapted for sheep, and being so, will undoubtedly prove themselves at all times quite superior to all the efforts of art, not only in the breeding but the feeding of them. So much less loss from sickness and death, and in the end producing to the butcher a much better killing animal as well as a better clip of wool to the stapler.

Waving any further preliminary remarks, I will now attempt, as lucidly as possible, to give an account of how the flocks on the two farms with which I am connected are successfully managed. Both farms are situated in the eastern and lower part of the Lammermuirs, in Berwickshire. The highest and most extensive of the two, which has mostly a north-eastern exposure, contains about 300 acres permanent hill-pasture, mostly dry, with a subsoil composed in a great measure of rotten rock, and sound and healthy for sheep; the grass being interspersed more or less with heather and whins, both of which are readily eaten by them in winter; while the rich yellow blooms of the latter are much in request amongst the lambs in summer. It also contains annually about 240 acres of grass and clover, one and two years old. The smaller and lower-situated farm, which lies a little to the north-east of the other, has chiefly a south-western exposure, and is possessed of a few fields of dark-coloured rich loamy soil; the remainder and larger portion of it, as to depth, character, and quality, being very much upon a par with the larger farm; a great deal of the soil, though thin and bare, being naturally adapted for the production of grass and turnips. It contains annually about 200 acres of grass of the

first and second year's growth (excepting a small proportion permanent and waste, which is generally pastured with cattle), sound and naturally well suited for sheep, the wetter fields having been all pretty well drained. So much for the farms, and now for the stock.

It may be as well to mention first, that the management of the sheep stock is founded on and ruled by the desire to obtain the following results—viz., by a judiciously liberal feeding of the ewes, to procure from them annually a very large return of lambs, it being thought more profitable thus to cause many of them to produce two lambs, than, by an injudicious withholding from them, particularly at certain seasons, a plentiful supply of food, have each only producing one, the wool in the one instance being also superior to the other, both in quantity and quality; to have the feeding flock—by endeavouring to keep them always in a progressive state—ready for the butcher at a very early age, at heavy weights, and leaving large returns of profits; to procure an excellent clip of wool, both as regards quantity and quality, from the breeding as well as the feeding flocks; and, lastly, to have as small a per-centage as possible of loss from disease and death.

The breeding flock, which consists of somewhere about twenty scores of half-bred ewes—a cross betwixt the Leicester and Cheviot—are, as a rule, kept constantly on the larger farm, so that they may derive the benefit of the permanent hill-pasture. They are of three different ages, two, three, and four years old, a third part being annually draughted and sold off at four years of age, after rearing their third crop of lambs. They are sold during the month of September to farmers of a lower district, who take another crop of lambs off them, and then feed them for the butcher. The reason for selling the ewes at four years of age is, because a much better price is got for them at that age, than they would fetch were they kept for another year, when many of their mouths would be getting deficient in teeth. Their room is filled up by the like number of gimmers of the same breed, carefully selected and purchased the previous year, while lambs, usually at Melrose fair, in the month of August. The selection of these is guided not so much by size as general beauty of appearance; such as fineness in the head, symmetrical, and clean-shanked, well-clad, &c. &c.

One point which is thought of very great moment, and rigidly adhered to, is to endeavour to have the ewes at all times, but especially at particular seasons, such as those of procreation and production, in good and healthy condition.

They are put to the tup about the first of November, so that there may be no lambs till the very end of March or the beginning of April, when there is an almost certainty of grasses being ready for them, it being thought of much greater importance for the ewes

to have plenty of succulent food, to stimulate an ample secretion of milk to enable them to nourish and rapidly further the growth, unchecked, of their lambs immediately after birth, than to have them lamb a week or two earlier, and run the hazard of an unpropitious spring, thereby allowing their lambs, from want of grass in sufficient abundance to produce a good flow of milk, to get checked and stunted in growth, from the effects of which it might be long ere they fully recovered. At this age, the injurious effects of a check from want of milk are incalculable.

To insure a large proportion of twins, the ewes, a short time before and during the procreative season, have a liberal supply of green food given them, such as rape or turnips. At one time the former was thought absolutely necessary, from its being believed to have a specific effect in stimulating their prolification; now, however, turnips, when given in sufficient quantities, are found practically to be equally efficacious. Either rape or turnips, experience has proved, assist more successfully towards the desired result when given a week or so before the tups are put amongst the ewes. When practicable, it is studied to have the rape or turnip which are intended for use at this season growing adjacent to a grass-field, and the ewes allowed unrestrained liberty to feed on either.

This is of great value in the best of weather, and in wet, quite indispensable; for to then keep them constantly folded on the break, could not fail to prove hurtful. Indeed, when rain continues to fall, it is thought requisite to confine them to the grass-field entirely, carting to them there what turnips they require: or if in such weather on rape, allowing them only to have two feeds a-day, of two or three hours' duration each, and again turning to grass. Let the weather be ever so dry and favourable, however, from the break they are as a rule turned to grass at night; and when much wet rests on the leaves of the turnips or rape in the morning from frost, &c., kept off until the sun or air has partially dispelled it. When this is not attended to, diarrhœa is almost sure to be the consequence to some of them. It may be as well to mention that, during the procreating month, the ewes are generally divided into two or three flocks, or occasionally kept all together from the force of circumstances. It is nevertheless thought the better plan to divide them. Seven, sometimes eight tups are used, five or six of them being close-woolled, well-clad Leicesters, selected and purchased at the sales of some of the best breeders in the county; and two from England, a cross betwixt the Leicester and Southdown, the produce of which, though at times coarse-looking, are found to be fully as easily fattened as those got by the pure Leicester, and on the average better weights.

All of the tups are purchased at one year old, and kept for two, sometimes for three seasons, according as they are found to answer the purpose required of them. They, like the ewes, are also seen

to, that they be in proper condition, some time before being allowed intercourse with them. About the end of November and beginning of December the tups are removed, and the ewes are shortened in their quantity of turnips to one feed of a few hours daily throughout the winter—less or more according to the mildness or severity of the weather. When off the turnip break, they either have the liberty of part of the one- and two-year-old grasses, or more generally turned to the hill pasture, where they have the heather and furze as well as healthful exercise. Great care is now taken to prevent them leaping fences or ditches, lest the embryo should become inverted in the uterus of some of them, and thereby cause great difficulty and danger in parturition.

Although in some years it is found unnecessary, and not done, generally speaking, the bathing or rather running of the ewes is resorted to for destroying the well-known insect which infests the sheep, commonly termed Kade or Tick, with a certain poisonous mixture prepared for the purpose, and sold by the most of ordinary druggists. At one time this was done usually before the tupping season, but now from experience it is believed to *have an injurious effect in limiting the number of twins*, and is therefore deferred until the end of December or beginning of January, according as weather permits, when they are very gently handled by the shepherd, and no bad results, such as abortion, which might then *theoretically* be dreaded, ensue. As the lambing season draws near, the turnips are gradually increased to the ewes, until at length, if they are not all the more likely to get into too good condition (approaching fat), they are allowed what they choose to eat, so that they may not only be full of healthy vigour for bringing forth their young, but likely to yield abundance of nourishing milk afterwards.

Some may unhesitatingly condemn such liberal and full feeding at this time, lest the ewe, by getting into a condition predisposing her to it, should become more liable to and fall a victim to an inflammatory attack. Without a doubt such danger does exist; but a distinction must be drawn between the healthy, vigorous state then desired, and the one that exceeds it, and which very properly cannot be too much dreaded. When within a day or two of the time of production—preparation having been previously made as to the repairing and plentiful bedding of the lambing shed, getting a supply of turnips stored conveniently near, &c. &c.—the part of the flock which are known by mark as those which produce first, are drawn out from the others and confined in a grass-field, where turnips are carted to them, and where they remain during the day, giving birth to their lambs, closely waited on either by the regular shepherd himself, or one hired in to assist him, to aid any of the ewes that may have difficulty in lambing; if cold, taking them to the shelter of the nearest place, or to little enclosures, made here and there for the purpose, of hurdles and straw, until they get afoot,

and begin to follow and suck their dams without assistance, when there is very little danger of them.

At nightfall the ewes are gently driven home into the lambing-shed,* where they receive the same attention, being waited on as through the day; the person that does so turning those that lamb into the small houses prepared for them until the morning, a few turnips being given from the store at hand. When the morning is favourable—that is to say, dry over-head, and not exceedingly cold—the lambs produced over-night are, with their dams, turned to grass some time during the forenoon; twins to young grass, single generally to the older grasses, the fields near the steading being first stocked, the older lambs being gradually transferred to the more distant to give place to the younger. In wet or severe weather, men, women, or boys are employed to assist the shepherd in driving ewes and lambs into shelter, and keeping them in it, plenty of turnips, &c., being laid down to prevent them wandering out seeking food amid the blast. At such a time, too, warm cow-milk is administered from a bottle carried by the shepherd in his pocket, to any of the lambs that seem really in want of it. It may do all very well for some to protest and affirm "cow milk to be not only objectionable for young lambs, but even extremely hurtful; and that, by taking advantage of some of the ewes that are extra good milkers, its use may wholly be dispensed with." Such may succeed excellently in moderate weather, and with a few ewes and lambs in folds or small fields; but where scores are distributed here and there in large fields and in cold, hard weather, when each ewe, however good a milker, has plenty to do with her own offspring, at such a time a few mouthfuls of warm cow-milk, to such as seem suffering from cold and hunger combined, proves of incalculable benefit,—the means of preventing them totally succumbing to their deadly influence. For without a doubt, food in abundance, in such weather, both to ewes and lambs, is invaluable, as without it, shelter, however good, loses one-half of its renovating effect.

When a stormy day threatens to be succeeded by as stormy and inclement a night, the youngest lambs with their dams are enclosed by a net in a sheltered corner of their respective fields, and straw carted out to add to their shelter and comfort; and in cases of urgent necessity, many of them are taken home to sheds and houses about the steading,—a good cart-shed, fitted up in a temporary manner with straw, &c., being very serviceable for such a purpose. As a rule, however, young lambs are confined as

* This is a long enclosure made by the use of hurdles on one side of the stack-yard, which has previously, during winter, been completely cleared of the stacks which occupied it. To keep the ewes clean and comfortable, it is now and then freshly bedded with clean dry straw. A stone wall, pointed with lime, encloses the north side of this shed, alongside of which, and facing into the shed, are a range of small houses formed with wood and straw—dry, warm, and comfortable—and into which the ewes with their young are confined for shelter till the morning.

short a time as possible, as they are found never to thrive so well as in the open air, if the weather will allow at all.

When the first lot of ewes is getting nearly all delivered, the second lot is drawn out and treated in like manner; and so also, in due time, the third and last lot. If turnips can be spared, even in fine weather a few cart-loads are occasionally laid thinly down in the sheltery bits of many of the grass-fields, which is a great assistance in the way of economising grass, as well as a very acceptable variety of food to the ewes, which eat considerable quantities of them in preference to grass alone, especially when a few cold days set in. For the production of milk, yellow turnips are found to be the best; oats are also thought to have a good effect that way, and are accordingly at times given to some of the worst milkers. Indeed, neither food nor attention are withheld when called for, as both most strongly and urgently are during the lambing season, every means being resorted to which at the time is thought can be of any avail in preserving the lives of both old and young, as well as promoting the rapid and healthy growth of the latter.

The tup lambs are castrated when from two to four weeks of age, according as weather will permit—favourable mornings being regarded as quite indispensable for this operation; choosing, rather as castrate in a frost-tainted atmosphere, or in a chill east or north-east wind, to delay for days until the air becomes genial—mild, soft, misty, growthy mornings being what is really desired for it. Instead of performing the operation in the scientific style—of making an incision on either side of the scrotum, and extracting the testicles—the shepherd here finds it much safer to excise the inferior part of it entirely, the blood getting thus more freely away without coagulating and causing mortification internally, as it will occasionally do when performed by the former method. About the middle and end of June the ewes are shorn. About that time the wool naturally begins to fall off itself, and were they shorn a fortnight sooner, more wool might be procured; only the danger then exists of a cold night or two setting in, and not only greatly and (to the lambs) injuriously lessening the secretion of milk, but even, in extreme instances, causing death to some of the ewes. Somewhere near the end of July the lambs are weaned and removed to the other farm, where grass for some time previous had been lightly pastured on purpose for them; where they are out of hearing of the bleating of the ewes, as well as the ewes of them—thus causing both to settle much more quickly than when nearer; while the lambs, being changed to better pasture prevents them from feeling to any great extent the sudden and total deprivation of milk. The ewes are afterwards hand-milked for a week or ten days, sometimes a fortnight, according to circumstances; allowing, near the finish, longer intervals to elapse between milkings before ceasing altogether, thus in a great measure preventing the bad

effects that might accrue from an overflow of milk being left to stagnate in the udder. By gently driving to and into the fold or bught, and the shepherd's waiting closely on to superintend the milking, seeingthat no unnecessary rough-handling or other abuse is practised, the milking is found not to be injurious in the smallest to the flock, but rather beneficial, in its preventing udders from going wrong from over-distension, besides yielding a large amount of rich valuable cheese. For a few days after the milking is left off, the shepherd, in walking about amongst the ewes, keeps a careful look-out, lest any of them require to be caught and relieved of part of their milk in the field. Immediately, also, about this time, a third part of the ewes are draughted out and put into one of the best fields of pasture, to prepare them for sale in September; while the others are kept chiefly on the hill pasture, until the oat stubbles are ready for them.

As to the feeding department, the lambs, which at weaning-time are removed to the lower farm and better pasture, are grazed there until folded on turnips. In dry autumns they are allowed the use of the young grasses as well as the bare stubble; but in wet, only the latter, it being found that the former does them then more harm than good; they, on the other hand, doing it a very serious and irreparable injury by the poaching of it with their feet. Even in dry weather it is thought advisable to turn them off to older pastures at night; as when young grass is, as it often is at that season, covered in the mornings with heavy cold damps and frosts, they ought not to be on it till some time through the course of the forenoon, or height of the day. The feeding sheep having been put on about a month earlier, towards the middle of October the whole of the home-bred or feeding lambs are folded on white turnips—on either farm—of the earlier or middle sowings, the later sown, even although of good size, being found to cause more sickness and death. A good-sized break is given to begin with, so that they may not by crowding destroy the turnips under foot. As soon as this is ready for picking, a second is given, and so on as required, never allowing them to get too bare before giving a fresh break, as deaths are in that case more apt to occur from eating too much earth-soiled turnip-roots in the one instance,* and too greedily of the fresh turnip-tops in the next.

They have along with the turnips—in the early part of winter—the use also of one or more of the adjoining grass-fields, on which

* In some districts, more especially where the soil is of a sandy nature, large numbers of sheep die from eating soiled roots. Sand accumulates in the stomach, and may sometimes be taken out in handfuls. Cleaning and cutting the roots is the only effectual preventive. When it happens that it is not convenient to do so, the stock should never be kept too bare of turnips in wet weather, and more particularly in changes from frost to thaw. This, no doubt, entails a greater waste of food, but the losses arising from deaths will be considerably diminished.—Ed.

they can run off and on at will: unless when more than the usual number of deaths are occurring, or the turnip-break getting very wet and muddy from heavy and continued falls of rain, when they are driven into and confined in the grass-field regularly every night for the benefit of a more comfortable lie, as well as change of food. Indeed, in such weather, it is often found necessary to shut them out from the break for days together; turnips being carted to them on grass, until the turnip-field gets again into a condition dry enough to receive them. In severe frosts and snow continued, a very small break is given them daily—what is found they can consume before nightfall: the portion of the bulbs above ground being eaten in the forenoon, and the roots picked up to them in the afternoon. Supporting this method with plenty of good oat-straw, sheep are enabled, in the hardest weather, to get on tolerably well. Towards the middle or end of January, twelve to fifteen scores of the best hoggs, of either sex, are drawn out, and have yellow or swedish turnips cut and given to them in troughs, a store having been previously prepared, in heaps of ten or twelve cart-loads pitted at regular intervals over the field in which they grew. All young sheep beginning at and before this time to lose their front teeth, it becomes of very great furtherance to their increase of growth and condition for the market, to cut the turnips for their use. It insures them a proper supply of food in a form easily consumed; and thus, in place of wandering about from root to root, nibbling from morning to night with almost toothless gums, without ever being satisfied, they walk forward to their troughs, eat what they desire, and then lie down to rest, ruminate, and assimilate. If enough of hands could be had to pull root and store in fine weather, there is little doubt but that it would amply remunerate to cut all kinds of turnips to hoggs at this time. But where there are large flocks and a number of cattle to provide for, this is not often practicable, when it is considered that dry weather for the purpose is absolutely necessary.

Those which are left to eat the turnips on the break, get a good proportion of the bulbs broken for them on the ground by the common picker, as soon as the green tops are eaten over. Such numbers of the hoggs having by that time lost the whole of their incisors, and the turnips getting so much thicker and tougher in the skin, makes it almost impossible for them to break them themselves. But when split into two or three pieces, allowing them to get an edge on which to bring their grinders into effectual use, helps much to get them sufficient to keep them from falling off in condition until they get to grass, when they improve very rapidly, more so than the lot that gets cut swedes.

If there is not all the greater scarcity of turnips, hoggs are kept off grass until it has grown strong and luxuriant, so that it may not be endangered of being easily cropped before the genial weather

of summer sets in to insure its rapid second growth, nothing proving more destructive to young grasses than the eating of them too closely in spring; but where numbers of ewes and lambs are kept and reared, such can rarely be avoided.

The lot of hoggs taken from the cut swedes or yellows are allowed the best grasses, to keep them still progressing as rapidly as possible for the market. The greater proportion of them are in prime condition about the middle or end of May, weighing then, on the average, from 17 to 18 pounds a-quarter. Having been washed eight or ten days previously, they are then shorn, and, a few of the worst having been drawn out, sold to the best advantage; the *shotts* being kept on grass a week or two longer, till also fit for sale.

As to the secondary lot fed on white turnips alone (uncut), they too are put to grass about the same time as the others, washed about the end of May, and shorn in June; a few of the best being afterwards drawn out at intervals of a few weeks, according as they are found to get into marketable condition, and sold, what remains on the ground in the end of August being fed off on turnips during the ensuing winter. The half-bred ewe lambs bought in to replace in due time the ewes draughted out, are usually allowed only about half turnips during the first month or two of winter, but afterwards as many as they can consume; for although it may appear an expensive way of treating keeping stock, the enhanced quality and the increased weight of the *wool, cause it more than to pay.*

And now for a very few remarks on the diseases of sheep.

Sheep, on the most of farms, and especially in certain seasons, and during their first year, are exceedingly liable to disease and death. Indeed, with some farmers, the mortality is so great as almost to preclude them from feeding any with a profit, confining their attention in that department wholly to cattle, which are sometimes, in that respect, from lung disease, &c., little better. It therefore becomes a question of very serious importance to all, but especially to such, whether something cannot be done in the way of in a great measure effectually preventing or successfully curing those diseases to which sheep generally fall victims. Some of our best veterinary authors, in their works of pathology, minutely and graphically describe the causes, symptoms, and means of cure of the most of these, and which I have read carefully and with due attention. Yet, with all respect for the opinions of these learned and able men of science, I cannot avoid being deeply impressed with the belief—and my impressions are produced by practical observation and experience—that the real and important question is, *not so much as to how many of the diseases affecting sheep are to be cured, as to how they are to be prevented.*

I attended at Clyde Street Veterinary College, session 1851-52,

and listened to the able and thoroughly practical instructions of Professor Dick on Pathology—to the calmly-delivered, clear, scientific, and never-to-be-forgotten lectures of the late Mr Barlow on comparative anatomy—to the earnest and intelligent Mr Finlay Dun on materia medica—and to the highly-interesting and impressive lectures of the late Dr George Wilson on chemistry—than which a better and more able staff of teachers of the veterinary art need not exist. I returned home in spring, flushed in theory with the already sanguine anticipation of seeing the most of diseases affecting the domesticated animals vanish before the potent appliances of my newly-acquired art. With horses and cattle I was not altogether disappointed. In them the symptoms often point pretty clearly to the seat of disease, and the means of cure employed have not been altogether unsuccessful. With sheep, however, I was doomed to disappointment, and find it totally otherwise. I had often heard, years before, farmers and shepherds, men of experience, talk about, as a well-known fact, of a sheep's being very difficult of cure; but now I experienced it. I felt totally baffled and disheartened. Sheep were brought home unwell without showing any peculiar symptoms so as to firmly guide the judgment as to what treatment to pursue. Purgatives, bleeding, sedatives, stimulants, were too often used almost at random, and too often unsuccessfully, the most of cases terminating fatally ere the medical treatment could have any effect, which, on *post-mortem* examination, often showed little or no appearance of great disorganisation internally to which could reasonably be attributed the cause of death. The gall rather gorged-looking, perhaps, or the bladder unnaturally full, gas-distended stomach, or spots of slight inflammation here and there on the different viscera and glands, especially in feeding sheep which have previously been doing well, are generally the only signs of disease that can be seen internally after death.

Undeniably there are a few diseases affecting sheep, however, which, by plain and well-known symptoms, give certain indication as to what is wrong, such as diarrhœa in thin and improperly-fed elder sheep and hoggs, inflammation in ewes after lambing, hydatid in the brain (*alias*, sturdy-turnsick), &c., which, by their course not being so rapidly run, give the practitioner a little time to attempt and effect a cure. And before saying more as to the means of prevention, I will first give here a few details as to how these have been by me successfully treated.

Diarrhœa.—This disease, so far as my experience goes, when not arising from the effects of some other disease prevailing in the system, chiefly affects lambs after being changed from grass to the turnip-break, especially if then in poor condition. Some seasons those affected soon again get well without any treatment whatever; while in others, again, the attack is very virulent—so much so, that

if not promptly met and checked, it in a short time proves fatal, impairing the appetite, the bowels and digestive viscera generally getting into a state of irritation so great as to almost wholly unfit them for assimilating any of the food, it passing off almost as when chewed in an unintermitting purge; abdomen getting very much tucked up; hollow sunken eye and weak staggering gait; death seemingly being caused occasionally by pure inanition, if dysentery does not first ensue to cut off at an earlier stage. In the cure of this disease I have used opium and castor-oil with success,—a scruple of the former to two or three ounces of the latter, given once every other day, or oftener if necessary, until the patient begins to show signs of recovery. Sometimes the first dose proves enough, and nothing more ought to be given than is thought absolutely necessary, lest it do harm.

In the first stage of diarrhœa, I have seen the use of scalded flour prove very beneficial in the way of cure, made of a consistence that will allow of its being easily administered out of a bottle, and given in quantities of about a choppin or two English pints two or three times a-day; but when not found very early to take effect, no time is lost in resorting to the opium and castor-oil.

Hydatid in the Brain—Sturdy-turnsick.—This is a disease affecting chiefly hoggs, too well known to need here any description as to symptoms Those, I think, that are much exposed and poorly fed are more predisposed to it; but very probably the cause or causes still remain in obscurity. A certain cure of at least 50 per cent, however, has now been discovered, and in limited use for several years. It is effected by the use of a case of instruments made specially for the purpose by several instrument-makers in Edinburgh—Hilliard in Nicolson Street is one; M'Kenzie, opposite the College, in same street, is another. The case consists of an instrument, with a shield upon it, for first perforating the skull; a small trochar and canula, which are next inserted, the former being then withdrawn, and the latter left as a canal through which the water is extracted from the brain by a syringe made to fit exactly into the mouth of the canula. The operation is exceedingly simple, and may be performed by any master or ordinary shepherd who chooses to act exactly according to the printed directions given along with each case of instruments. Some talk of curing 70 to 80 per cent, or more even. Very probably the per-centage of cures depends very much on the breed, strength, and condition of the sheep practised upon. For my own part, I will, I think, first and last, have attempted a cure on about 40 or 50 hoggs, once and twice crossed with the Leicester from the Cheviot, and proved successful in curing fully half of that number. The greatest proportion of the cures were made when the disease was not too far gone, before it had reduced the patient to a very great extent, when the weather was temperate—when kept quiet, and not allowed to

go out too soon after the operation. Perhaps the most profitable way of dealing with sturdy sheep in good condition is to sell them at once to the butcher for what they will bring; but amongst hill-bred, thin-keeping stock, this invention of cure must be of very great value, saving many a hogg which, if allowed to die, or killed at the time, from its leanness, could be of little or no value, but which, when cured, thrives, feeds, and sells as well as any of the others.

Inflammation after lambing is another very common and exceedingly fatal malady amongst ewes in certain seasons, more especially if they have been too full fed, causing lambs to grow unnaturally large before parturition, thereby increasing the danger to the mother, already predisposed by high condition to become the victim of this disease. When the symptoms of its attack are given, by heaving and after-throes coming on a few hours, or it may be a few days, after lambing, a pail or pitcher full of water—spring water, as cold as can be had—is taken and poured over the loins and hind-quarters of the patient by the use of a smaller vessel, held as high as the arm can reach to cause a greater shock when the water descends. It is wonderful to see its salutary effect. The ewe, which before had been panting, heaving, and throeing, becomes instantly quiet, soothed, calmed, and relieved, while the cold icy spring-liquid descends upon her. By-and-by, however, the throes return, when the water is again had recourse to with the same visibly good effect, and so continued at intervals until the gradual and finally permanent cessation of the throes plainly indicates that the malady, with its concomitant dangers, has been energetically met and conquered. This cure, however simple—so simple that some may perhaps never try it from unbelief in its efficacy—I have experienced as almost infallible. The prescription of it was given me by a friend three or four years ago, who first procured it from a hill sheep-farmer, whose name at present has quite escaped my memory, although to him, I believe, is due the credit of the discovery. The shepherd here has tried it in at least a dozen of cases, which he stoutly affirmed, and I from unsuccessful practice believed, would, by the ordinary treatment of bleeding and administration of sedatives, such as opium, &c., all to a certainty have died, but which, by the application of the water, all but two, I think, recovered. While undergoing this treatment of cure, the ewe is kept sheltered from draughts of cold or scorching heat, both being extremely hurtful. A dose of two ounces of epsom salts is also given to keep the bowels in proper order.

Garget.—Garget, or inflammation of the udder, is first prognosed by a slight redness and heat in one or both sides of the udder, which is accompanied by an unusually large secretion of milk, which very soon degenerates into milk and serum, next into bloody serum, and lastly to gangrene, which, if not checked, rapidly spreads

down inside the thighs and along the abdomen, ending fatally. The supposed causes of its production are—from the ewe having sore teats, refusing to allow her lambs to suck, inflammation being in consequence set up by her retention of milk; sudden changes in the weather from heat to cold, and *vice versâ*; too succulent pasture. But in reality, cases now and then occur seemingly without any exciting cause whatever. When a ewe is observed to move off whenever her lambs attempt to suck, she is at once caught and examined, and if her teats are seen to be at all sore, cleaned and touched with a little caustic or other application, and her udder emptied at least once a-day by the aid of an ordinary silver teat-tube. When it is thought to be the pasture that is the cause of it, they are changed to another.

In the cure of garget, I have seen poultices, fomentations, cold washes, each and all applied at the first stage, to endeavour to stay the inflammation from running to gangrene, with seldom any success, the most of the cases going to gangrene in at least part of the udder. When this shows itself by discoloration outside, a deep free incision is made, and oil of turpentine, or some other potent stimulant, poured into it two or three times a-day, to bring it to a healthy suppuration. A liberal allowance of strong sweet ale is also given. Bleeding and purgatives are avoided almost from the very first, being found to hasten on mortification, when purgation arises spontaneously. Notwithstanding all that can be done, some of the ewes will sink and die, while others gradually rally; healthy suppuration ensues, and the gangrenous portions slough off, when the sores, though very deeply seated and bad to look at, from the acquired healthy action, rapidly heal up, the ewes in a short time becoming again quite strong and healthy—unable, however, from their udders being wholly or partially destroyed, to rear their lambs, which have to make the best shift they can on cow-milk.

Such are a very few of the most common diseases attacking sheep, which I have experienced as giving unmistakable symptoms to guide the judgment as to what treatment to pursue, and often with success. And yet, I again repeat, as to the generality of diseases, especially those prevailing most among feeding sheep, my firm belief is, we must look to the prevention of them as the real sheet-anchor of success in sheep husbandry. Probably, let the treatment pursued in the management of sheep be ever so good, and naturally adapted to the promotion of their health, a certain quantity of deaths annually will occur amongst them; and this is what every stock-farmer believes and expects as a matter of course —a law of nature. But it is also a well-known fact, that on certain farms many more deaths occur than on others, influenced, no doubt, greatly by soil, situation, management, and methods of feeding. In some seasons this expected and wonted fatality becomes doubled, tripled, and more. The question then is, What is the

cause of this, and what the prevention? One of the chief causes most believe to be, and in all probability correctly, some peculiarity in the season, mild wet winters, want of frost. But then, allowing that either of these is the predisposing and active cause for the time, how does it happen that some extensive farmers, even in such seasons, escape with little or no more loss than usual? Most probably because their management in summer and autumn had been more adapted to the healthy and steady progress of the sheep, telling favourably for months afterwards. In the treatment of lambs, for instance, one thing which is of great effect towards their living and doing well on turnips during winter is, to keep them in a steady progressive state on grass, but especially to have them so when they leave it for turnips.

Going off grass in thin and poor condition, diarrhœa amongst many of them is almost sure to be produced at once, by the luxuriant tops and juicy nutritious bulbs of the turnip. It is much better when lambs are poor, before folding them on continuously, to allow them for a few weeks at first to go on only so many hours each day, and turn again to grass, however bare, gradually increasing the length of time allowed on the break, till it is thought they may with safety be permitted to stay on day and night. By this management I believe turnips not only to be saved, but the flock much more benefited, and their health in a great measure preserved.

When any disease whatever attacks a flock, and day after day one or more fall victims to it, a change of food infallibly proves of very great effect in mitigating its ravages, and finally eradicating it. Few, I daresay, when they see the flock as a whole feeding and fattening rapidly on a certain field of turnips, care about changing it to another, where the chance exists that they might not feed so well; but when two evils are forced upon our choice, it becomes only a matter of consideration or opinion which is the least.

Rock-salt is considered by some as a very good preventive of disease. A good-sized flock will not consume a great quantity of it—many of them perhaps scarcely tasting it. Some, however, seem to relish it exceedingly, again and again walking forward to the troughs and licking and nibbling at the pieces they contain. Such may be incited to do so by a natural instinctive craving to replace a want of salt in the blood, which, when not thus or otherwise supplied to them, may be one of the causes of disease. Be that as it may, salt does no harm, costs little, and very probably promotes health to the sheep that use it, especially to hoggs, which, feeding very rapidly in very mild warm spring weather, are predisposed to inflammatory fever, of something of the same type that attacks yearling calves, or indeed even more quickly fatal. As this is a disease amongst sheep that I have not heard of as having yet become general, it may be as well to say here a few words about

it. I have rarely seen it attack any kind of sheep but hoggs on cut swedes, which were feeding unusually fast, during unseasonably mild, sunny, warm weather, and hoggs which had newly lost their fleeces in unseasonably cold weather. So rapidly does it prove fatal, that it is often difficult for the shepherd to prevent those affected with this disease from dying in the blood. The flock may seem all well, and within a very few hours after one of its number be found lying dead, almost in the natural position as when resting, with a little bloody froth about the mouth and nostrils. Such has even occurred through the day, with a man waiting upon them. On skinning those that have thus died, spots, or it may be whole quarters, are found to be in a gangrenous condition; an effusion of black blood, intermixed with small bladders of gas, having taken place in the *facia*, betwixt the skin and the flesh. When it has cut off one of a flock, a few more may assuredly be expected to follow, unless preventive measures are at once adopted; the most effectual of which will be found to be, a run off to grass, and fewer turnips given for a time. At such a crisis, supplying them with rock-salt may have, indeed I almost believe, from what I have witnessed, has a beneficial effect, without lessening the turnips, or running off to grass. But still I would strenuously advocate in this, as in the generality of diseases affecting sheep, a change, as the safest, surest, and most simple of all preventives. Change of situation, change of field, change of food—in short, change of any kind that may be and is within the reach of any sheep-farmer, together with keeping them always in a steadily progressive, healthy, improving condition, and not half-starving them one day, week, or month, and over-feeding the next, are, I feel convinced, not only the surest means of prevention of disease amongst sheep that can be used, but also much the most profitable method as to the feeding of them, believing as I do that variety as well as quantity and quality of food has much to do with the celerity of their fattening and increase of weight. Of course, as already remarked, even under the best of management, cases of disease will occur, and must be looked for. As to such, in conclusion, I again reiterate, as my opinion, formed from observation, if they are sheep with any amount of mutton on them, it is much more profitable never to attempt a cure at all, as nine out of ten are almost certain to die in the blood ere medical treatment, be it good or bad, can take effect, and the whole lost; and therefore much better to abstract the blood as soon as signs of disease are discovered, ere the mutton gets greatly deteriorated, and sell it for what it will bring.

REPORT ON PLANTING OF WASTE LAND.

By J. B. WEBSTER, Balmoral.

[Premium—The Gold Medal.]

THE planting of waste land in high-lying districts of the country has now become a subject of great importance to landed proprietors. Having been intrusted with the laying down of extensive plantations on high and exposed situations, I offer the following remarks as the results of my experience and observation.

Extent.—The plantation which I would bring under your notice at present, comprises an area of about 300 imperial acres. Its elevation varies from 1000 to 1400 feet above the level of the sea, and it is 50 miles from the same. It was planted during the years 1853-4-5.

Climate.—The general climate of the locality is very changeable. In winter there is a greater abundance of snow, and the frost is more severe than in the low country. In summer, however, the air is pure and bracing, and the heat is often powerfully reflected from the mountains into the narrow glens, which causes vegetation, in favourable seasons, to make rapid progress.

Division No. 1 contains about 90 imperial acres, and is situated at an elevation varying from 1000 to 1400 feet above the level of the sea, with a north and north-east exposure. The general appearance of the surface is rugged and mountainous, more especially on the north exposure, where large masses of shattered rock occasionally protrude above the surface of the ground, sometimes rising abruptly several hundred feet. The natural plants found here were the following:—Common heath (*Erica vulgaris*), whortleberry (*Vaccinium vitis-idæa*), Alpine ladies-mantle (*Alchemilla alpina*), club-moss (*Lycopodium clavatum*), with a few trees growing among the clefts of the rocks, planted by the hand of nature, and all in perfect health. The following are the sorts:—Scots fir (*Pinus sylvestris*), aspen poplar (*Populus tremula*), and the common birch (*Betula alba*). The soil is a naturally dry and light sandy loam, from 1 to 24 inches in depth, resting upon granite rock.

The trees planted on this division consist of one year's transplanted Scots firs, and one year's transplanted larch, raised from Tyrolese seed. They were planted at 3½ feet apart; two firs being planted for each larch, or 2370 firs, and 1186 larch per imperial acre, the mode of planting adopted being the cutting of a cross-notch with the common spade. In preparing for planting operations, as soon as the plants arrive I open the bundles out, and have the plants carefully sheughed into a piece of garden-ground, to be

removed to the hill with a cart as the planters require them. By this means the plants are always quite fresh; and should frost and snow set in, those lying in the *sheugh* or furrow, with their roots covered with dry friable mould, are as safe and secure as they were before being removed from the nursery.

The next point to which I would advert, in regard to the system of management, is the placing of the plants properly into the ground when planting. As the surface here is rough and rocky, great care is requisite in order to have proper notches opened to receive the roots of the plants; the men were often obliged to shift a few inches from one place to another before that end was attained. In all such cases I directed the planters not to be particular with regard to the exact distance between the plants, but to open the notches where the soil appeared to be most favourable for the reception of the roots, although a little wider or narrower. In opening the notches, each cut with the spade ought to be perpendicular, and not in a slanting direction. The notch should also be opened wide enough to receive the roots at their full stretch, and great care taken to see that they are not doubled in nor drawn together, but each root placed in the position it occupied before its removal from the nursery; and that they should be inserted in the ground no deeper than what is essentially necessary to cover them, and keep the plants in their position.

The prevailing weather while planting this division was fresh and cloudy. The severest weather, for a month after planting, was a snow-storm with hard frost.

The plants here, when the elevation and exposure are taken into consideration, have made wonderful progress, and they afford a striking illustration of what may be attained in bringing vast tracts of comparatively worthless heath-ground under a profitable crop of useful timber; and it is not the less striking to see a cold and bleak hill, in the course of a few years, as the trees advance, gradually throw off its gloomy appearance, and assume a new and pleasing aspect; such improvements never fail to command admiration, and certainly rank among the finest features of alpine scenery. I now consider this plantation thoroughly established. It requires no planting a second time, as no blanks have ever made the least appearance in it.

The Tyrolese larch, though planted on the most exposed situations of the hill, has completely outstripped the common larch in the rapidity of its growth, and in the fine healthy appearance of its foliage. On looking over the plants this autumn (October 1859), I find the growths of the larch on this division of the hill to be from 6 to 24 inches for the present season, and those of the Scots firs from 4 to 12 inches.

The following is the expense incurred in planting an imperial acre on this division, where no drains are required:—

2370 one-year transplanted Scots firs at 7s. 6d.,	£0 17 9
1186 one-year transplanted Tyrolese larch at 9s.,	0 10 9
Carriage of plants, ...	0 1 0
Expense planting one acre, . . .	0 12 6
Proportion of expense in fencing one acre,	0 9 7½
Total, ...	£2 11 7½

Division No. 2 consists of about 7 imperial acres of thin gravelly soil, resting upon granite rock. It is situated on the summit of the hill, and has a north and north-west exposure. The natural vegetation, mode of planting, weather while planting, and for one month after the operation, and the system of management, the same as in division No. 1. The trees planted on this consist of an equal number of one year's transplanted Scots firs, one year's transplanted common larch, and birch 8 inches in length, planted at 3½ feet apart. The plants were well selected, somewhat short, and of a robust appearance. The whole have thriven remarkably well, and no blanks have occurred. The appearance, however, of the larch is rather delicate in comparison with the Tyrolese; but the firs and birch are all that could be desired, and are appearing to take the lead on this division. The following is the expense incurred per acre on this division, where no draining is required:—

1186 one-year transplanted Scots firs, at 7s. 6d., . .	£0 8 11
1185 one-year transplanted common larch (selected), at 12s. 6d.,	0 14 9¾
1185 eight-inch birch, at 12s. 6d., ...	0 14 9¾
Carriage of plants, ...	0 1 0
Planting per acre, ...	0 12 6
Proportion of expense in fencing per acre, ...	0 9 7½
	£3 1 8

Division No. 3 contains about 153 acres, situated on the south side of the hill, and moderately sheltered from the north by the high rocky ground of districts No. 1 and 2, and at an elevation ranging from 1100 to 1300 feet above the sea. The soil upon the sloping sides of the hill is chiefly of a light gravelly nature, with some small patches approaching nearly to a light sandy loam, resting partly upon granite rock, and partly upon beds of gravel containing large boulder-stones and granite rock underneath. The natural vegetation consisted of the following plants, in addition to those found on district No. 1:—Dwarf furze (*Ulex nanus*), winter-green (*Pyrola rotundifolia*), hard-fern (*Blechnum boreale*), St John's wort (*Hypericum montanum*), (*H. perforatum*), and wild strawberry (*Fragaria vesca*).

The trees planted on this division consisted principally of 2 years' seedling Scots firs, and 2 years' seedling common larch, with the exception of about 15 acres of the poorest soil, where the plants were one year's transplanted firs and larch. They were put in at 4 feet apart—two firs being planted for each larch, as in division No. 1, or equal to 2722 plants per acre. The weather while

planting was generally fresh, but often cold, with high winds and drizzly showers of rain and sleet. The severest weather, for a month after planting, was a snow-storm, with hard frost. The mode of planting and system of management was the same as already described. The plants here are doing remarkably well, more especially the Scots firs, their growths for the present year being from 3 to 10 inches, and of a fine healthy appearance. There is, however, a marked difference here between the common larch and the Tyrolese, their growths being from 3 to 15 inches; nor is their foliage of such a dark-green healthy colour, nor so well developed, as the Tyrolese. They have, however, stood remarkably well, and though not making so luxuriant growths, I have as yet seen no symptoms of disease among them. The expense incurred per acre on this division stands thus, no draining required:—

1815 Scots firs, medium price per 1000, 3s. 4d., . .	£0	6	0¼
907 larch, medium price per 1000, 6s. 3d., . . .	0	5	8
Carriage of plants, ...	0	1	0
Planting per acre, ...	0	12	6
Proportion of expense in fencing per acre, . . .	0	9	7½
	£1	14	10

Division No. 4 contains about 50 imperial acres, situated on the south-west side of the hill, at an elevation varying from 1000 to 1200 feet above the level of the sea. The soil is chiefly of a light gravelly nature, having a thin coating of moss upon the surface, and resting upon an open gravelly bottom, and some parts having a small portion of clay. Here and there large boulder-stones protrude above the surface of the ground. The natural plants found here were much the same as those on division No. 3. The trees planted consist of one year's transplanted Scots firs, one year's transplanted common larch, and Norway spruce 8 inches in length; an equal number of each, and planted 4 feet apart. The mode of planting and system of management the same as formerly described. The weather while planting was generally dry, with frequent cold and cutting winds from the west and north-west. The weather for a month after the operation was hard and droughty.

The progress of the plants in this case is similar to that of those on division No. 3; but from the drought setting in immediately after planting, I found them more tardy in commencing to grow than those planted in autumn and winter. I have invariably found that planting in the end of the year succeeds better than that done in spring, provided the soil is of a light dry nature. The reason of which is, that the notches are not so apt to open up with the drought, and there is likewise a little soil washed down to the roots with the rain during winter, which the young and tender roots readily take hold of when the growing season commences. The following is the expense incurred in planting 1 imperial acre on this division, drains not required:—

907 Norway spruce, at 4s. 6d., .	£0 4 1
907 common larch, at 7s. 6d., .	0 6 9¼
908 Scots firs, at 6s. 3d., . .	0 5 8
Carriage of plants, . . .	0 1 0
Planting per acre, . . .	0 12 6
Proportion of expense in fencing an acre,	0 9 7¼
	£1 19 8

Fencing.—The fence which encloses the above plantation consists partly of a dry-stone dyke, and partly of an upright wooden paling. The dyke commences at the eastmost point of the hill, and runs along the south boundary for a distance of 1900 lineal yards, where it is joined by an upright wooden paling which runs along in the same direction as the dyke for a distance of 1006 lineal yards. At this point it joins another enclosure which skirts the west side of the hill.

The following is a specification for the building of the dyke:—

First,—The dyke to be built under the present agreement, commences at the eastmost point of the hill of Craiglowrican, on the estate of Balmoral, and runs along the south side of the said hill, as shown by a row of wooden pegs stuck into the ground.

Second,—The contractor must select, and take in all the stones for building—the stones to be selected on the hill wherever they may be found most convenient.

Third,—The dyke to be 5 feet high, and any soft mould or moss which may occur upon the line of surface must be stripped off, and the foundation laid upon the hard subsoil.

Fourth,—The said dyke to be built to a frame 4 feet high, 36 inches wide at bottom, and 17 inches wide at top. The base course to be neatly built and levelled at the height of 18 inches, with extra depth at hollow places, to stand 1½ inches over the frame at its base, and 1 inch at the levelling, and no more. The body of the dyke to be of the best rubble dyke-work, at 33 inches in height the dyke to have a row of through-band stones, one at least to every 6 feet in length; the whole to be properly bolstered, packed, and pinned up.

Fifth,—The cope and rickle to stand 12 inches high. The cope to be well-selected flat stones, and must project 2 inches over the doubles. The whole to be finished in a regular and workmanlike manner by the   of   , and to meet the approval of any properly qualified person, to be appointed by the proprietor's commissioner, as inspector of the work.

Sixth,—The whole of the work to be done in terms of the above specifications, by Mr ———, contractor, at the price of 1s. 2d. per lineal yard.*

Timber-Fencing.—An upright wooden fence to be erected, com-

* The common price for building a dyke of this kind in the district is about 8d. the lineal yard, if the stones are laid down to the contractor.

mencing at the termination of the said dyke, to run along the south side of the hill, and join the fence which encloses the hill on the opposite side; posts to be 6 feet 6 inches long, by 6 inches in diameter at the small end, put in 24 inches deep, and 6 feet apart from centre to centre; one horizontal rail of half-tree, 4 inches through, put on with overlap joints, to run flush with the top of the posts, and strongly spiked with 4-inch nails; the upright stobs to be 5 feet 6 inches long, 2¼ inches in diameter, driven into the ground close to each other, and firmly spiked to the horizontal rail with D.D. nails. To stand, when finished, 5 feet above the surface of the ground.

This part of the work not being contracted for, the following is the outlay for its erection—the wood, being selected from the thinnings of the young plantations on the estate, is not charged:—

2 horses dragging and carting 30 lineal yards of paling from the woods, a distance of three miles, at 5s. each per day,	£0	10	0
2 men preparing wood, at 2s. each per day,	0	4	0
Men's time putting up the same,	0	5	0
Nails for do.,	0	1	0
	£1	0	0

The average expense per lineal yard being 8d., the amount for fencing would stand thus:—

To 1006 lineal yards paling, at 8d.,	£33	10	8
„ 1900 lineal yards dyke, at 1s. 2d.,	110	16	8
	£144	7	4

From a careful observation of the relative merits of the above two modes of fencing, I prefer stone dyke, as it makes by far the most substantial fence, and, if properly constructed, will last a number of years without requiring the least repair; on the other hand, the paling fence, after standing five or six years, begins to rot, and is then often in need of repair. We have planted about 1000 imperial acres within the past few years, and we now use no other sort of fence but the stone dyke, as we find it most efficient, and by far the cheapest in the end.

In conclusion, it might not be out of place to remark, that in this locality—at Lochnagar—I have found the remains of old fir-trees at an elevation of 2500 feet above sea-level. From the appearance of the roots and trunks, although now considerably wasted, I should suppose them to have averaged from 6 to 12 inches in diameter above the surface of the ground. At a lower elevation, in Glengelder, I have found the remains of trunks and roots of fir at a depth of from 3 to 4 feet. These were often charred, as if the forest had been consumed by fire. In a bog, also, at the bottom of a narrow ravine, I found the remains of an oak tree, at an elevation of 1000 feet above sea-level. The trunk was very

much decayed, being partly covered with bog earth, and partly above the surface, but almost hid from view by some plants of the bog myrtle (*Myrica gale*). On measuring the trunk, I found the average diameter to be 24 inches. I must confess I was surprised on finding an oak tree in such a situation, but on looking about, I observed, on a dry bank on the opposite side of the ravine, a few plants of the common brake (*Pteris aquilina*), and the earth-nut (*Bunium flexuosum*), with others, which I have always found occupying good soil. On examining the ground, I found it to consist of a good deep loam, resting upon mouldering red granite. I have no doubt but the oak tree had at one time flourished on that very spot. Near the quarry bridge, at the west end of Craig Gowen, about the same elevation, I have found the remains of oaks in a bog, showing that the oak had at one time flourished in this locality. When it is remembered that trees have once grown in such situations, it requires no argument to point out the utility of planting them. I have not the least doubt about its success, provided the work be done on rational principles, and under the superintendence of a person of experience. I would advise that all planting operations be done well, even although at a few shillings of extra expense. Economy is certainly a point which ought to be considered at all times, but it should never be adopted at a sacrifice of efficiency.

ROYAL WARRANT FOR A CHARTER TO THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND, 1834.

WILLIAM *R.*

OUR Sovereign Lord, considering that, on an humble Petition presented to His Majesty King George III., His Majesty's Royal Father, of gracious memory, by and on behalf of John Duke of Argyll, then President, and Charles Earl of Aboyne, the Honourable Henry Erskine, Dean of the Faculty of Advocates, Sir William Forbes of Pitsligo, Baronet, and Robert Dundas, Esq., the Younger of Arniston, His Majesty's Solicitor-General for Scotland, all now deceased, then Vice-Presidents of the Society, called *The Highland Society at Edinburgh*, setting forth, that, in the year 1784, the petitioners and other persons had formed themselves into a Society by the name or title of *The Highland Society at Edinburgh*, their objects being to inquire into the state of the Highlands and Islands of Scotland, and of the inhabitants, and into the means of the improvement of that part of the country, by the establishment of towns, villages, and harbours, facilitating the communication through the different parts of the Highlands by roads and bridges, extending and promoting

the fisheries, encouraging agriculture, and introducing useful manufactures, and by thus uniting the exertions of the proprietors of land and others, to call the attention of the public to the promotion of such beneficial objects, his Majesty's said royal father did, by Charter or Letters-Patent, bearing date the 17th of May, in the year 1787, constitute, erect, and incorporate the said petitioners, and the other persons who were then members of the said Society, and such other persons as should thereafter be admitted members thereof, into one body politic and corporate, or legal incorporation, by the name and title of *The Highland Society of Scotland at Edinburgh*, with the powers and under the regulations particularly narrated in the said Charter or Letters-Patent.

And our Sovereign Lord further considering, that, in an humble petition presented to his Majesty by Walter Francis Duke of Buccleuch and Queensbery, President, George Duke of Gordon, George Granville Duke of Sutherland, George Marquis of Tweeddale, and Archibald John Earl of Rosebery, Vice-Presidents, in name and on behalf of themselves, and of the whole other members of *The Highland Society of Scotland at Edinburgh*, incorporated as aforesaid, it is set forth, that the said Society, since its erection into a body corporate, had continued to promote the laudable and patriotic purposes of its institution, which had been productive of great benefit to the country; that from the general approbation with which its exertions had been viewed by the public, the Society had received a large accession of members, and that it now consisted of about nineteen hundred members, including a very large proportion of the noblemen and gentlemen of rank, property, and professional eminence in Scotland; that whilst the Society had continued to devote a great share of its attention to the Highlands of Scotland, it had of late years been enabled, from the general support which it had received, gradually to extend the sphere of its usefulness, by giving considerable sums annually in premiums for the purpose of improving agriculture, encouraging industry, and rewarding useful inventions in the arts therewith connected, all over Scotland; and also representing to his Majesty, that the Society having applied its funds in a way which experience had shown to be highly advantageous, is fully satisfied that a continuance of its attention to the improvement of agriculture and the different branches of rural industry, and the arts therewith connected, all over Scotland, as well as to such of the original objects of the institution as may still be beneficially advanced by the Society's exertions, would be eminently beneficial to that part of the United Kingdom, as well as to the nation at large: And further setting forth, that this extension of the purposes of the institution had been approved of and acted upon by the Society for several years, and that certain alterations in the rules and regulations of the Society, and a variation or extension in their designation or title had been specially

approved of at and by a general meeting of the Society, held at Edinburgh on the 12th day of May 1834,—Therefore praying that his Majesty would be graciously pleased to grant a new or supplementary Royal Charter or Letters-Patent, under the seal appointed by the Treaty of Union to be kept and used in Scotland in place of the great seal formerly used there, of new nominating, constituting, and appointing the petitioners and the other members of the Society, and such other persons as shall be afterwards admitted members thereof, agreeably to the rules of the Society, into one body politic and corporate, or legal incorporation, by the name and title of "The Highland and Agricultural Society of Scotland," and under the regulations mentioned in the said petition: And his Majesty being satisfied that the design of the petitioners is laudable, and that the patriotic purposes of the said Society eminently deserve encouragement, does therefore ordain a Charter or Letters-Patent, to be passed and expede under the seal appointed by the Treaty of Union to be kept and used in Scotland in place of the great seal formerly used there, constituting, and of new erecting and incorporating, as his Majesty, by his prerogative-royal, and of his special grace, for himself and his royal successors, hereby of new constitutes, erects, and incorporates the said petitioners, and the whole other persons who now are members of the said Society, and such persons as shall hereafter be admitted members thereof, agreeably to the rules of the said Society, into one body politic and corporate, or legal incorporation for ever, by the name and style of The Highland and Agricultural Society of Scotland, which is in future to be the name of the said Society instead of "The Highland Society of Scotland at Edinburgh," which they at present use, and as such and by such name and title hereby granted, to have perpetual endurance and succession; with power to the said Society, under the aforesaid name and title, to purchase, take, hold, receive, enjoy, possess, and retain for the uses and purposes of the Society, lands, tenements, or hereditaments, or any estate or interest therein, not exceeding the sum of £2000 sterling of yearly rent or value, after deducting feu-duties, land-tax, ministers' stipend, and other public burdens; and to sell, exchange, or dispose of the same; as also to hold, take, receive, enjoy, possess, and retain for the uses and purposes of the Society, all such sum and sums of money, annual rents, goods, and other personal property, as have already been paid, given, received, devised, or bequeathed, or shall at any time hereafter be paid, given, received, devised, or bequeathed, for the uses and purposes of the said Society, under the original or the former corporate name, or the name, style, and title hereby granted; and with full powers also to the said Society to lend out the money, funds, and effects, already acquired and received, or to be acquired and received, on such security, heritable or personal, in Scotland, or in the stock of any of the incorporated banks, or in

the public funds of the United Kingdom, as may be determined and approved of in manner after mentioned; declaring that all charters, dispositions, heritable securities, and all other deeds affecting property, heritable or personal, to be granted to or by the said Society, shall be taken to and granted by the said Society in the corporate name and title hereby granted,—that is, to "The Highland and Agricultural Society of Scotland," without specifying the names of the President, or any of the office-bearers, or constituent members of the said Society: And that all charters, dispositions, or other deeds of conveyance, contracts, discharges, renunciations, acquittances, or other deeds whatever, touching the real estate or the capital of the said Society, granted by the said Society, shall be subscribed by any three of the Ordinary Directors, along with the Treasurer, or, in his absence, along with the Honorary Secretary for the time being, and shall be executed at one or other of the stated general meetings of the Society, or at any meeting of Directors specially summoned for that purpose, and that all such deeds or instruments shall be equally valid and effectual as if the same had been signed by the whole members or Directors of the said Society: And his Majesty, by these presents, for himself, his heirs, and successors, declares and ordains that all such lands or other heritages, and also all such sum or sums of money, stocks, funds, bonds, heritable or personal, mortgages, or other securities for money whatsoever, as shall at the date of this Charter be held, or shall stand secured or vested for the interest or behoof of the said Society under the former corporate name, or in the name of any office-bearer or office-bearers, or other persons, may and shall continue invested for the purposes of the said Society as now of new incorporated, until the same respectively can be conveniently called up and reinvested, or transferred, or assigned, and duly vested in the said Society, by and agreeably to the name, style, and title hereby granted; and that all deeds and other instruments necessary for the conveying, assigning, discharging, and reinvesting the same, shall be subscribed and executed in the manner and according to the form above prescribed: And all actions or proceedings at law at the instance of the Society may be brought and maintained in the name of the said Honorary Secretary in his official capacity, and that the death, resignation, or removal of such Secretary shall not abate or prejudice any such actions or proceedings at law, but the same may be continued, prosecuted, and carried on in the name of any other Honorary Secretary for the time being, in the same manner as if he had been an original party thereto: And with power likewise to have and use a common seal, and to change, alter, break, and make new the same from time to time as to the said Society shall seem expedient; and otherwise, and in all other things, to act, and do, and proceed in such manner as the law permits, and as is usual in the case of

persons incorporated, and with all the privileges incident to such incorporations: And further approving, as his Majesty hereby approves, of the following regulations made by the said Society; That is to say, *First*, the said Society shall consist of two classes, Ordinary, and Honorary or Corresponding Members. The number of the honorary or corresponding members resident in the United Kingdom of Great Britain and Ireland shall not exceed twenty, but with power to the Society to elect as Honorary Associates persons resident abroad, not subjects of his Majesty, who may have been benefactors to the Society, or who are distinguished for their skill in art or science, provided that the number of such foreign associates shall not exceed twenty. *Second*, The mode of election of members, ordinary or honorary, shall be by ballot, at one or other of the stated general meetings, and in the manner to be prescribed by any regulation or bye-law to be made thereanent, as hereinafter directed. *Third*, The Society shall hold two general meetings in each year, one upon the second Tuesday in January,* and another upon any lawful day of the months of June or July, which the Directors of the Society shall fix annually at any of their ordinary meetings in May or June, and make known by advertisement in any two or more of the Edinburgh newspapers, at least eight days before such meeting: And it shall be in the power of the Directors to call occasional general meetings, previous intimation of such general meetings, and the purpose thereof, being made by advertisement in any two or more of the said newspapers, at least ten days before such meeting. At the said general meetings of the Society, twenty shall be a quorum; and the President, or, in his absence, one of the Vice-Presidents; or, in the absence of the Vice-Presidents, any member who has held the office of President or Vice-President; and, in the absence of these, the senior Director present, shall preside; and all questions before general meetings shall be decided by a majority of votes of the members present. *Fourth*, The Society shall annually, at the general meeting in January, choose, out of the ordinary members, a President, four Vice-Presidents, a Treasurer, and an Honorary Secretary. And the Society shall also annually, at the said General Meeting in January, choose out of their ordinary members, who are usually resident in Edinburgh or in its immediate vicinity, a Board of Thirty Directors, of whom at least Seven shall be newly elected; and also Ten Extraordinary Directors, who may be only occasionally resident in Edinburgh; which several President, Vice-Presidents, Directors, ordinary and extraordinary, Treasurer and Honorary Secretary, shall manage and direct the ordinary business

* This provision has been altered by the supplementary charter of 1856, which authorises the Directors to summon the General Meeting "for any lawful day in January," and it has been resolved that, under ordinary circumstances, it shall be held on the third Wednesday of that month.

of the Society in all matters, in compliance with the constitution, bye-laws, and regulations of the Institution:—Declaring that, in all meetings of the Directors, seven shall be a quorum; that the President, senior Vice-President, or, in their absence, the senior ordinary Director present, shall be Chairman of the meeting; and that the Preses or Chairman of all meetings of the Directors, and of all general meetings of the Society or Incorporation as aforesaid, shall have a deliberative vote; and, in case of an equality, also a casting-vote. *Fifth*, The Directors shall annually appoint a Secretary for conducting the general business of the Society, and also any other officers or servants they may find necessary to employ; and the Directors shall fix the salaries or allowances to be paid to such Secretary and other officers or servants: but the said appointment of a Secretary and other officers or servants receiving salaries, and the salaries or allowances to be paid to them, shall always be subject to the approbation of the Society at their general meeting in January; and the Directors shall also have the power to remove the Secretary and other officers or servants appointed by them: and those who at present act as President, Vice-Presidents, Directors, and officers of the said Society, shall continue, and have the power of officiating as such, until the next general meeting of the Society, on the second Tuesday of January next ensuing, when the President, Vice-President, and other necessary officers, shall be elected and approved of for the then next ensuing year. *Sixth*, The ordinary members of the Society shall pay upon admission, and afterwards annually, towards the general fund of the Society, such sum or sums as the Society may from time to time fix and declare, by any regulation or bye-law in manner hereinafter directed; with power to the said members to redeem the annual contribution by a payment in one sum as the purchase of a life subscription, at such rate as the said Society shall from time to time authorise and appoint. The honorary or corresponding members and foreign associates shall not be subject to any annual contribution or other payment. Each ordinary member of the Society shall pay his annual contribution for the preceding year at or before the general meeting in January, or otherwise he shall have no vote. Any person elected an ordinary member of the Society, who shall not have objected to his election, on the same being intimated to him by the Secretary, shall not be entitled to resign or withdraw his name as a member of the Society, unless he shall have paid up his life subscription, or shall have previously settled and paid, in annual contributions, a sum equal to that fixed by the Society at the time of his election, to be paid by members as the purchase of a life subscription, in lieu and in redemption of the annual payments: and the Directors shall have power to cause actions or proceedings at law to be instituted against members in arrear of their annual payments, for recovery of such arrears; and it shall

not form a bar or valid defence against such actions or proceedings, that the member has tendered his resignation: and it shall be in the power of the Society to expel any member, for any cause which shall appear to a general meeting to require that proceeding; and all such persons shall thereupon cease to be members, or to have any right or interest in the Society or its concerns accordingly. *Seventh*, The annual payments by the ordinary members of the Society, or sums paid in lieu thereof as contributions for life, shall be paid to the Treasurer, or to any collector to be named by him, such collector being bound to find security for his intromissions, to the satisfaction of the Directors; and he shall receive such remuneration as the Directors shall from time to time fix and determine: and all sums received by the Treasurer or Collector shall be lodged with the Royal Bank of Scotland, or with such other bank or banking company as the Directors shall appoint; and neither the Treasurer nor the Collector shall at any time retain any balance of the funds in his or their hands greater than £50 sterling. *Eighth*, The funds hitherto acquired, and now belonging to the Society, shall form a part of its capital stock; and all the monies to be hereafter received as life subscriptions or the price or redemption of the annual contributions of members, shall, either in whole, or to such amount as the Society shall at any time direct and appoint, be added to the capital,—the interest, dividends, or annual produce of which only shall be applicable to the general purposes of the Society; and any donations or bequests that may be made to the Society, which shall not be otherwise devised, shall also form a part of, and be added to the capital, and may be employed in the purchase of lands, houses, or other heritable subjects, under the qualifications and restrictions above mentioned, or be invested upon proper security, heritable or personal, in Scotland, or in bank-stock, or in the public funds, by the authority of the Directors, subject to the approbation of a general meeting: and no part of the capital, either already acquired or to be so formed, shall be afterwards applied, except by authority of a general meeting, and upon intimation of the intended application being made at two meetings of the Board of Directors previous to such general meeting; but the Directors, with the approbation of the Society, shall at all times have power to uplift the said capital, or any part thereof, for the purpose of reinvesting the same on any other security which may appear to them preferable, or in the purchase of lands or other heritable property, to the annual value before specified; but no part of the capital shall be lent, originally, or upon reinvestment, to any person or persons holding an official situation or appointment under the Society at the time the same is to be lent or reinvested. *Ninth*, The Society, at its general meetings, shall have power to apply the revenues of the Society for the purposes of the institution, and to put at the disposal of the Directors annually certain sums, to be

applied by them in such manner as may appear to them to be most conducive to its interests, but with and under the provisions before made as to the capital stock. *Tenth*, All orders or warrants for application of money, shall express the purpose of such application, and shall be signed by the Preses of the general meeting, or of the meeting of Directors at which they may be authorised; and shall also be countersigned by the Treasurer, or, in his absence, by the Honorary Secretary. The Treasurer shall annually make out a detailed account of the income and expenditure of the Society, and of the state of the Society's funds; and the Directors shall annually, at their meeting immediately preceding the general meeting of the Society in January, have the accounts of the Treasurer audited, and a state of the funds of the Society made up; and the Treasurer shall produce the said accounts and state of the funds at the general meeting of the Society in January, and submit an abstract or abbreviated view thereof, for the consideration of the Society: The accounts shall also be produced at every meeting of the Board of Directors for their inspection, all conformably to the usage of the Society. And his Majesty wills and appoints, that the said regulations be duly observed, giving and granting nevertheless, as his Majesty, for himself and his royal successors, of new gives and grants to the members of the said incorporated Society, and their successors, at their general meetings, assembled from time to time, full power to alter or annul any of the bye-laws, rules, or regulations at present in observance, and to make such other bye-laws, rules, regulations, or orders, as they, or the majority of them present at such meetings, shall judge proper and necessary, for the better government and direction of the said Incorporation; and afterwards to alter or annul the said regulations herein before recited, as well as the bye-laws, rules, regulations, and orders, to be made in future, or any of them, as the members of the said Incorporation so assembled, or the major part of them present at such general meeting, shall deem proper and requisite: And his Majesty wills and directs, that all the bye-laws, rules, regulations, and orders, made as aforesaid, shall, until altered, be duly observed and kept, provided that the same are noways contrary to the law of the realm, and to the general purport and meaning of his Majesty's said Charter and Letters-Patent; and provided likewise, that such bye-laws, rules, regulations, and orders, or any of them, and every alteration thereof, shall be notified at two meetings of the Board of Directors previous to the general meeting of the said Incorporation at which they are proposed to be made, declared, or altered; and shall also be confirmed in and by the next general meeting of the said Incorporation, held and kept after they shall have been respectively made as aforesaid: And his Majesty does, for himself and his heirs and successors, declare, that the said Charter or Letters-Patent shall be in and by all things valid and effectual in law, according to the true intent and

meaning thereof, and shall be taken, construed, and adjudged, in the manner most favourable and beneficial for the best advantage of the said Incorporation, notwithstanding any misrecital, defect, uncertainty, or imperfection in the same: And his Majesty doth further will and command, that this Charter do pass the seal appointed by the Treaty of Union to be kept and used in Scotland in place of the great seal thereof formerly used there, without passing any other seal or register: For doing whereof, these presents shall be to the Director of his Majesty's Chancery in Scotland, and to the keeper of the said seal, and their deputies, a sufficient warrant. Given at his Majesty's Court of St James's, the 18th day of June 1834, in the fourth year of his Majesty's reign.

By his Majesty's Command, MELBOURNE.

BYE-LAWS.

1. *Annual Subscription of £1, 3s. 6d., and Life Composition.*—That the Ordinary Members of the Society shall pay at admission, and afterwards annually, in advance, the sum of £1, 3s. 6d., with the option and power of redeeming the same by payment of Twelve Guineas, as the purchase of a Life Subscription; and which Life Subscription may be so purchased under deduction of any annual payments that the Member may have previously made, with this limitation, that at no time shall a Member have the power of redeeming the annual payments for a less sum than £7, 1s., or six years' annual contributions.

2. *Annual Subscription of 10s, and Life Composition.*—That Tenant-Farmers, Secretaries and Treasurers of Local Agricultural Associations, Factors, and Proprietors farming the whole of their own lands, whose assessment in the Valuation Roll does not exceed £500, shall pay at admission, and afterwards annually, in advance, the sum of Ten Shillings, with the option and power of redeeming the same by payment of Five Guineas as the purchase of a Life Subscription.

3. *Election of Members.*—The mode of Election of Members of the Society shall be by ballot, at either of the stated General Meetings,—at which at least twenty Members must be present. The names of all Candidates for admission as Members shall be lodged with the Secretary, and laid before the Directors, previous to the General Meeting at which they are to be proposed; and such persons, whose names shall have been so lodged, as shall be approved of by four parts in five of the Members balloting, shall be declared to be duly elected. Honorary or Corresponding Members or Associates shall not be declared duly elected unless three-fourths of the Members present at the General Meeting at which they are proposed shall have voted for them.

4. *General Ballot.*—The Society, when a ballot for Ordinary Members is to commence, and after the names and designations of the Candidates have been read over, shall have the power, by the unanimous consent of the Members present, to dispense with the form of individual ballot, provided it shall appear to the satisfaction of the Meeting that the names of the whole Candidates on the list have been read and approved of in and by the Meeting of the Directors immediately preceding such General Meeting; and, in this case, the election shall be deemed and held to have been made by ballot, according to the intent and meaning of the Charter.

5. *Election of Office-Bearers.*—The President shall not continue in office for more than four consecutive years. The two Senior Vice-Presidents, and the seven senior Ordinary Directors, and such number of the Extraordinary Directors, not being fewer than Two nor more than Five, as the Society may determine, shall retire annually; and the President, Vice-Presidents, and Directors, Ordinary and Extraordinary, who so vacate office, shall not be eligible to be re-elected in the same capacity for at least one year. Any Ordinary Director who shall not have attended a meeting of the Board of Directors for one year, unless prevented by bad health, shall be held to have vacated his seat in the Direction. The list of Office-Bearers to be proposed by the Directors for election at the General Meeting shall be published in any two or more of the Edinburgh newspapers, fourteen days preceding.

6. *Meetings of Directors.*—The Board of Directors shall meet on the first Wednesday of each month during the sittings of the Court of Session, and occasionally, as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Committees shall be appointed by the Directors, and shall in all cases report procedure to them for their consideration and approval. The Directors shall keep a record of their proceedings, to be laid before the General Meetings for their consideration and direction. All Members of the Society, though not in the Direction, may attend the meetings of the Directors and deliver their opinion, but they shall have no vote. The President, Vice-Presidents, Directors, Ordinary and Extraordinary, Treasurer and Honorary Secretary, shall be entitled to vote at meetings of the Board.

7. *Motions at General Meetings.*—That at General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision, unless notice thereof has been given a week previously to the Board of Directors, without prejudice, however, to the competency of making such motion or proposal to the effect of its being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting.

8. *Duties of Secretary.*—The Secretary shall write the minutes and proceedings, carry on the ordinary correspondence of the Society, and superintend the keeping of the records, papers, and correspondence. All records, papers, correspondence, and accounts shall be subject to the inspection of the Board of Directors, or any Member thereof.

9. *Secretary to act as Collector.*—The Treasurer, if he does not collect himself, shall nominate the Secretary as Collector, and the Annual Subscriptions and Life Compositions of Members shall be paid to him in that capacity.

10. *Warrants for Money.*—Orders or Warrants for the application of money shall be attested by the signature of the Secretary, previously to being signed by the Preses of the General Meeting, or of the Meeting of Directors at which they may be authorised.

11. *Auditor of Accounts.*—The Society shall, at the General Meeting in January, elect a professional Accountant, as Auditor of the Society's Accounts, who shall accordingly audit the Treasurer and Collector's Accounts annually, and for that purpose all necessary data shall be furnished to him by the Secretary not later than 30th November.

12. *Annual Accounts.*—The financial year shall be reckoned from the first lawful day of December to the last lawful day of November. A detailed Annual Account of the Income and Expenditure of the Society, and of the State of the Society's Funds for that period, shall be submitted to the Directors in December, and the Abstract thereof required by the Charter shall be published in the Society's Transactions on the 1st of January following; the detailed Accounts and State of Funds shall be laid by the Treasurer before the General Meeting in January, such Accounts and Abstract being under the signature of the Auditor, and of two Members of the Committee of Finance.

13. *Auditor's Duties.*—In the examination of the Accounts of the Secretary and Collector, which shall be kept in a form to be approved by the Directors, and shall exhibit the whole of the monetary intromissions of the Society, it shall be the duty of the Auditor to direct his attention to all points essential to a *bonâ fide* audit, including the ascertainment of the following particulars:—

1st, The due realisation and bringing to Account of the various items of which the Society's Income is composed.

2d, The accuracy of the Entries and Summations of the details of Charge and Discharge.

3d. The correspondence of the details of Discharge with the Vouchers for substantiating them.

4th, The sufficiency of the authority for Disbursements, both in reference to the Warrants of the Directors, or of General Meetings.

5th, That the requirements of the Charter, with respect to Capital, have been observed.

AGRICULTURAL EDUCATION: ROYAL WARRANT FOR CHARTER IN FAVOUR OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND, 1856.

OUR Sovereign Lady considering that the Highland Society of Scotland at Edinburgh was incorporated by charter or letters-patent granted by his Majesty George III., bearing date the 17th day of May, in the year 1787; that the said Society was of new incorporated by the name and style of the Highland and Agricultural Society of Scotland by charter or letters-patent granted by his Majesty William IV., bearing date the 18th day of June, and sealed and registered the 7th day of July in the year 1834; that in an humble petition presented to her Majesty by the said Highland and Agricultural Society, it is, *inter alia*, set forth that the said Society was incorporated for the purpose at first of promoting the general improvement of the Highlands of Scotland, and thereafter of advancing the art of agriculture throughout the entire extent of her ancient kingdom; that the means hitherto adopted by the said Society for carrying the latter purpose into effect have been the granting of premiums for agricultural improvements, the holding of shows of cattle, implements, and produce, and the general promotion of the science and practice of agriculture; that other means, however, were open for effecting the same object, of which one is to encourage the proper education of agriculturists; that this encouragement may, in the opinion of the Society, best be afforded by directing young agriculturists to a suitable course of study, and by examining and certifying their successful prosecution thereof; that the duty of determining the said curriculum of study, and of examining and certifying the proficiency of the students who have passed through it, may properly be discharged by the said Society through the medium of a Committee, but that to enable them to appoint such a Committee with the requisite powers, her Majesty's authority was necessary, and therefore, praying her Majesty to grant to them a supplementary charter conferring the said powers: And her Majesty being satisfied that the design of the petitioners is laudable, and that its execution will prove highly beneficial to the public; therefore in supplement of, and in addition to the powers conferred by the charters above set forth, ordains a charter or letters-patent to be passed or expede under the seal appointed by the Treaty of Union to be kept and used in Scotland in place of the Great Seal formerly used there, authorising and empowering the members of the said incorporated Society and their successors, at their general meetings assembled, from time to time, in order to encourage the proper education of agriculturists in Scotland, to constitute and appoint a committee, to be called "The Council of the Highland and Agricultural Society of Scotland on Education," and which Council shall consist of the following members—viz., the President of the said Society, the Lord Justice-General of Scotland, the Lord Advocate of Scotland, the Dean of the Faculty of Advo-

cates, the Professors of Agriculture, Anatomy, Botany, Chemistry, Natural History, and Technology in the University of Edinburgh, all for the time being, and seven other members of the said Society to be chosen from time to time by the Directors of the said Society, and approved of at a general meeting thereof, of which Council the President of the said Society shall be President, and the Lord Justice-General, Vice-President, and five of its members shall be a quorum: And her Majesty hereby empowers and requires the said Council to appoint a Board of Examiners, and to grant to students in agriculture diplomas bearing the corporate seal of the said Society, and certifying their proficiency in the arts and sciences connected with agriculture: And her Majesty gives and grants power to the members of the said incorporated Society, and their successors, at their general meetings assembled from time to time, on the report of the said Council, to make and enact all such bye-laws, rules, or regulations, in regard to the course of study to be required of such students, the mode and subjects of examination, and generally for carrying into effect the purposes of her Majesty's said charter or letters-patent, and the powers thereby granted, as they or the major part of them present at such meetings shall deem proper and requisite, and afterwards to alter or annul the same or any of them, and that in the manner specified in the said charter of his Majesty William IV, with regard to the bye-laws, rules, and regulations therein mentioned. And whereas by the said recited charter it is provided and declared that "the Society shall hold two general meetings in each year, one upon the second Tuesday in January, and another on any lawful day in the months of June or July," and seeing that the objects of the Society would be promoted were the provisions in regard to the first of these meetings altered, her Majesty gives and grants permission to the Directors of the said Society to summon such general meeting for any lawful day in January, on the notice and advertisement prescribed in said recited charter. And her Majesty does for herself, and her heirs and successors, declare that the said charter or letters-patent shall be in and by all things valid and effectual in law, according to the true intent and meaning thereof, and shall be taken, construed, and adjudged in the manner most favourable and beneficial for the best advantage of the said Incorporation, notwithstanding any misrecital, defect, uncertainty, or imperfection in the same. And her Majesty doth further will and command that this charter do pass the seal appointed by the Treaty of Union to be kept and used in Scotland in place of the great seal formerly used there, without passing any other seal or register. For doing whereof, these presents shall be to the Director of her Majesty's Chancery in Scotland, and to the keeper of the said seal and their deputies, a sufficient warrant.

Given at her Majesty's Court at Saint James's, the 18th day of August 1856, in the 20th year of her Majesty's reign.

By Her Majesty's command, G. GREY.

BYE-LAWS.

1. That in terms of a Report by the Council on Education, the following Board of Examiners be appointed:—

Science and Practice of Agriculture—Mechanics, and Architecture of the Farm—Professor JOHN WILSON; GEORGE HOPE, Fenton Barns; ROBERT RUSSELL, Kilwhiss; and JOHN WILSON, Edington Mains.
Botany—Professor BALFOUR.
Chemistry—Professor THOMAS ANDERSON.
Natural History—Professor ALLMAN.
Veterinary Surgery—Professor DICK.
Field Engineering and Surveying—JOHN MILLER of Leithen, C.E., and JAMES STIRLING, C.E.
Book-Keeping and Accounts—KENNETH MACKENZIE, Accountant, and PETER M'LAGAN, of Pumpherston.

2. That it shall be competent for said Board from time to time to receive for examination, and to recommend for the Society's agricultural diploma, candidates who shall have attained their 21st year, and who shall exhibit the vouchers, and pass an examination on the subjects hereinafter prescribed.

3. That the vouchers to be exhibited shall be such as to afford satisfactory evidence to the Board—*1st*, That the candidate has attended a farm, and been engaged in the practical operations thereof for a period of two years, or for two separate periods of not less than one year each. *2dly*, That the candidate has attended, for another period of two years, or for separate periods of not less than one year each, the following classes in some seminary recognised by the Board as sufficient:—Agriculture, Chemistry, Natural History, Botany, Veterinary Medicine, and Surgery.

4. That the candidate's knowledge of practical husbandry, and of the foregoing branches of study, as well as of Technology, Field Engineering and Surveying, Farm Mechanics and Architecture and Book-keeping, shall be established to the satisfaction of the Board by means of a strict examination.

5. That upon a report made by the Board to the Council on Education, stating that a candidate has exhibited the vouchers and passed the examination required, the Council shall issue, in favour of such candidate, a diploma bearing the corporate seal of the Society, and certifying his proficiency in the arts and sciences connected with agriculture.

PREMIUMS AWARDED BY THE SOCIETY IN 1859.

I.—REPORTS.

1. The gold medal to James B. Bird, Renton Barns, Berwickshire, for a Report on the Management of Sheep.
2. The gold medal to the Rev. James Duncan, Old Manse, Denholm, Roxburghshire, for a Report on the Natural History of the Turnip Fly.
3. The gold medal to James Fulton, Temple, Maryhill, Glasgow, for a Report on the Cultivation of Italian Rye Grass.
4. The gold medal to Robert Hutchison of Carlowrie, West Lothian, for Report and Plans of Labourers' Cottages.
5. The gold medal to Kennedy M'Nab, Inverness, for a Report on the Diseases of Swine.
6. The gold medal to James Porter, Monymusk, Aberdeenshire, for a Report on Top Dressing Pasture.
7. The gold medal to Robert Scot Skirving, Camptoun, East-Lothian, for a Report on the Cultivation of Mangold-Wurzel.
8. The medium gold medal to Wm. Horn, land-steward, Broom Hall Farm, Scole, Norfolk, for a Report of Experiments with different descriptions of Food for Cattle and Sheep.
9. The silver medal to Andrew Tait, Bankhouse, Penicuik, for a Report on Planting Hedges.

II.—DISTRICT COMPETITIONS.

CATTLE.

The County of Kincardine.

Bulls.		Robert Walker, Portlethen, Aberdeen,	Silver Medal.		
Bulls, Class I.	1.	James Patton, West Moston, Fettercairn,	L4	0	0*
" "	2.	David Scott, of Balnakettle, . .	2	0	0*
Bulls, Class II.		Robert Walker, Portlethen, Aberdeen,	2	10	0†
Heifers.	1.	John Smith, Pitgarvie, Fettercairn, .	2	10	0‡
"	2.	Alexander Brown, Powburn, Fettercairn,	1	10	0‡

The District of Garioch.

Bulls, Class I.	1.	Alexander Sim, Fawells, Keith Hall,	L.4	0	0*
" "	2.	John Maitland, Balhagarty, Keith Hall,	2	0	0*
Bulls, Class II.		James Ledingham, Rayne, . .	5	0	0
Heifers.	1.	James Stephen, Conglass, Keith Hall,	2	10	0‡
"	2.	James Anderson, Lochend, Rayne, .	1	10	0‡

The District of Strathspey.

Bulls, Class I.	1.	Sweton Fraser, Auchernack, Grantown,	L.8	0	0
" "	2.	Thomas Low, Ballimore, Abernethy,	4	0	0
Bulls, Class II.		John Gordon, Ballintomb, Grantown,	2	10	0†
Heifers.	1.	Alexander Stewart, Mains of Dalvey, Advie,	2	10	0‡
"	2.	John Gordon, Ballintomb, Grantown,	1	10	0‡

* Class I., Bulls calved before 1st January 1855.
† Class II., Bulls calved after 1st January 1855.
‡ Half Premiums awarded, the number of lots being under six.

The Stewartry of Kirkcudbright.

Bulls.		Thomas Biggar, of Chapelton,	Silver Medal.		
Bulls, Class I.	1.	Robert Kerr, Redcastle, Haugh of Urr,	L.8	0	0
" "	2.	William Haining, Three Merkland, do.,	4	0	0
Bulls, Class II.		James Graham, Meikle Culloch, Dalbeattie,	5	0	0
Heifers.	1.	James Graham, Meikle Culloch, Dalbeattie,	5	0	0
"	2.	John Cunningham, Whitecairn, .	3	0	0

The District of Lorn.

Bulls.		Rev. A. G. Cameron, of Barcaldine,	Silver Medal.		
Bulls, Class I.	1.	John Stevenson, Balimore, . .	L.8	0	0
" "	2.	John M'Phail, Dunollybeg, . .	4	0	0
Bulls, Class II.		Duncan M'Callum, Kilmaronaig, .	2	10	0†
Heifers.	1.	Colin M'Callum, Balligown, . .	5	0	0
"	2.	John Stevenson, Balimore, . .	3	0	0

The District of the Perth, Fife, Kinross, and Clackmannan Association.

Bulls.		The Earl of Airlie, . . .	Silver Medal.		
Bulls, Class I.	1.	John M'Laren, Monzie, Blair Athole,	L.4	0	0*
" "	2.	Robert Peter, Aberfeldy, . .	2	0	0*

The District of Mar.

Bulls.		Captain Grant of Tillyfour. . .	Silver Medal.		
Bulls, Class I.	1.	Messrs Fowler, Sauchen; and Donald, Waukmill, Kintore	L.8	0	0
" "	2.	Alex. R. Walker, Wester Fintray, .	4	0	0
Bulls, Class II.		Silvester Campbell, Kinnellar, Blackburn,	5	0	0
Heifers.	1.	Silvester Campbell, Kinnellar, Blackburn,	5	0	0*
"	2.	Alex. R. Walker, Wester Fintray, .	3	0	0

The Middle Ward of Lanarkshire.

Bulls.	James Allan, West Mains, Stonehouse,	Silver Medal.

The County of Elgin.

Cows.	John Collie, Ardgay, Forres, . .	Silver Medal.

DRAUGHT HORSES.

The County of Stirling.

Mares.	James Coubrough, Blairtummoch, Campsie,	L.10	0	0
Fillies.	James Adam, Muir-park, St Ninians, .	5	0	0

The County of Wigtown.

Mares.	Robert Anderson, Drumore, Stranraer,	L.10	0	0
Fillies.	John M'Clew, Dinvin, Port Patrick, .	5	0	0

The County of Forfar.

Stallions.	Charles Noble, Berryhill, Peterhead, .	L.25	0	0
Mares.	Alexander Arklay, Murroes, Dundee, .	10	0	0
Fillies.	P. Anderson, Carlungie, Dundee, .	5	0	0

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* Class I., Bulls calved before 1st January 1855.
† Class II., Bulls calved after 1st January 1855.
‡ Half Premiums awarded, the number of lots being under six.

The Island of Bute.

STALLIONS.	A. & J. Drummond, Blacklaw, Dunfermline,	L.25 0 0

The County of Dumfries.

MARES.	Isaac Fawkes, Outertown Annan, .	L.10 0 0
FILLIES.	William Muir, Hardington Mains; Biggar,	5 0 0

ENTIRE COLTS.

The District of Lauderdale.

TWO-YEAR-OLD COLTS.	John Peake, Craigend, Stow, . .	L.3 0 0*
ONE-YEAR-OLD COLTS.	James Laurie, Mitchelson, Stow, .	4 0 0

The District of Kintyre.

TWO-YEAR-OLD-COLTS.	Thos. Gemmell, Dalrioch, Campbeltown,	L.6 0 0
ONE-YEAR-OLD-COLTS.	James Smith, Darlochan, Campbeltown,	4 0 0

LEICESTER SHEEP.

The District of the Border Union Society.

TUPS.	Rev. R. W. Bosanquet, Rock, Alnwick,	Silver Medal.
SHEARLING TUPS.	Thomas Simson, Blainslie, Lauder, .	L.5 0 0

The District of the Perth, Fife, Kinross, and Clackmannan Society.

TUPS.	Lord Kinnaird, K.T., Rossie Priory,	Silver Medal.
TUPS.	David Wallace, Balgrummo, Leven, .	L.5 0 0
SHEARLING TUPS.	David Wallace, Balgrummo, Leven, .	5 0 0
EWES.	Thomas Ferguson, Kinnochtry, Coupar-Angus,	5 0 0
SHEARLING EWES.	David Wallace, Balgrummo, Leven, .	2 0 0*

CHEVIOT SHEEP.

The County of Sutherland.

TUPS.	William Houstoun, Kintradwell, Golspie,	Silver Medal.
TUPS.	John B. Dudgeon, Crakaig, Golspie, .	L.5 0 0
SHEARLING TUPS.	Marcus Gunn, Culgower, Golspie, .	5 0 0
EWES.	William Houstoun, Kintradwell, Golspie,	2 10 0*
SHEARLING EWES.	Marcus Gunn, Culgower, Golspie,	2 0 0*

The District of Nithsdale.

TUPS.	George Lorimer, Kirkland, Sanquhar,	Silver Medal.
TUPS.	James Brydon, Moodlaw, Langholm, .	L.5 0 0
SHEARLING TUPS.	David Paterson, Wood, Dumfries, .	5 0 0
EWES.	David Paterson, Wood, Dumfries, .	5 0 0
SHEARLING EWES.	David Paterson. Wood, Dumfries, .	4 0 0

The District of Annandale.

TUPS.	James Johnstone, Capplegill, Moffat,	Silver Medal.
TUPS.	John Carruthers, Kirkhill, Moffat, .	L.5 0 0
SHEARLING TUPS.	James Brydon, Moodlaw, Langholm, .	5 0 0
EWES.	James Brydon, Moodlaw, Langholm, .	2 10 0*
SHEARLING EWES.	James Brydon, Moodlaw, Langholm, .	2 0 0*

Half Premiums awarded, the number of lots being under six.

The Districts of Mull and Morven.

TUPS.	John Campbell of Possill, . . .	Silver Medal.
TUPS.	W. E. Oliver, Glenforsa, Aros, . .	L.5 0 0
SHEARLING TUPS.	D. & E. Thorburn, Muck, Tobermory, .	5 0 0
EWES.	W. E. Oliver, Glenforsa, Aros, . .	5 0 0
SHEARLING EWES.	D. & E. Thorburn, Muck, Tobermory, .	4 0 0

The Districts of Gairloch aud Lochbroom.

TUPS.	H. Mackenzie of Dundonnell, Ullapool, .	Silver Medal.
,,	D. Mundell, of Auchindrean, Dingwall, .	L.5 0 0
SHEARLING TUPS.	Walter Mundell, of Inverhael, Dingwall, .	5 0 0
EWES.	Walter Mundell, of Inverhael, Dingwall, .	5 0 0
SHEARLING EWES.	D. Mundell, of Auchindrean, Dingwall, .	4 0 0

BLACKFACED SHEEP.

The District of Lochaber.

TUPS.	Andrew Fraser, Camisky, Fort-William, .	L.5 0 0
SHEARLING TUPS.	Andrew Fraser, Camisky, Fort-William, .	5 0 0
EWES.	Alex. Campbell, of Monzie, Fort-William,	5 0 0
SHEARLING EWES.	James Linton, Cornanan, Fort-William, .	4 0 0

The County of Wigtown.

TUPS.	David M'Culloch, Auchness, Stranraer, .	Silver Medal.
,,	Robert Moffat, Glenwhillie, New Luce, .	L.2 10 0
SHEARLING TUPS.	Andrew Lusk, Craigcaffie, Stranraer, .	2 10 0
EWES.	Robert Moffat, Glenhillie, New Luce, .	5 0 0
SHEARLING EWES.	William Drynan, Craig, Glenluce, .	4 0 0*

The District of Athole.

TUPS.	The Duke of Athole, K.T., . .	Silver Medal.
,,	A. & N. Stewart, Dalchalloch, Blair Athole,	L 5 0 0
SHEARLING TUPS.	Robert Elliot, Laighwood, Dunkeld, .	2 10 0*
SHEARLING EWES.	Robert Elliot, Laighwood, Dunkeld, .	2 0 0*

The Island of Arran.

TUPS.	Robt. Crawford, Glenscorrodale, Lamlash,	L.5 0 0
SHEARLING TUPS.	Robt. Crawford, Glenscorrodale, Lamlash,	5 0 0
EWES.	Alexander Nicol, Monyquil, Brodick, .	5 0 0
SHEARLING EWES.	James Allan, Clauchan, Brodick, .	4 0 0

The District of the Gatehouse Society.

TUPS.	Jas. M'Geoch, Craignell, Newton-Stewart,	L.5 0 0
SHEARLING TUPS.	A. M'Cutcheon, Buchan, Newton-Stewart,	5 0 0
SHEARLING EWES.	Alex. Meggat, Glengap, Kirkcudbright, .	4 0 0

The Districts of Breadalbane and Weem.

TUPS.	The Marquis of Breadalbane, K.T. .	Silver Medal.

SHEEP-SHEARING.

The Silver Medal was awarded to William Tod, Glenree, at a Competition held at Auchencairn, Lamlash.

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* Half Premiums awarded, the number of lots being under six.

SWINE.

The County of Renfrew.

BOARS.	Robert Carswell, Barrhead,	Silver Medal.
SOWS.	1. Alexander Carswell, Barrhead,	L.1 10 0*
	2. John M'Kay, Barrhead,	0 10 0*

The District of Annandale.

BOARS.	1. James Smith, Newfield, Rutwell,	L.4 0 0
	2. Miss Bell, Woodhouselee, Canonbie,	2 0 0
SOWS.	1. John Birrell, Guards, Gretna,	3 0 0
	2. Campbell M'Lean, Annan,	1 0 0

DAIRY PRODUCE.

The District of the Forbes and Fordyce Society.

CURED BUTTER.	Mrs Forbes of Boyndlie,	Silver Medal.
Do.	1. Mrs Henderson, Craigmaud,	L.3 0 0
Do.	2. Mrs Watson, Scelmanae,	2 0 0
SWEET MILK CHEESE.	Mrs Forbes of Boyndlie,	Silver Medal.
	1. Mrs Stewart, Sandhole,	L.3 0 0
	2. Mrs Pittendrigh, Whitewall,	2 0 0

The Rhins District of Wigtownshire.

CURED BUTTER.	Colonel James M'Douall of Logan,	Silver Medal.
Do.	1. John Paterson, Colfin, Stranraer,	L.3 0 0
Do.	2. Andrew Lusk, Craigcaffie, Stranraer,	2 0 0
SWEET MILK CHEESE.	John M'Clew, Dinvin, Port-Patrick,	Silver Medal.
Do.	1. David Frederick, Dumbreddan, Stranraer,	L.3 0 0
Do.	2. Wm. M'Master, Challoch, Stranraer,	2 0 0

The County of Ayr.

CURED BUTTER.	John D. Boswell of Garallan, Ayr,	Silver Medal.
Do.	1. Matthew Dick, Hillhouse, Riccarton,	L.3 0 0
Do.	2. David Murchland, Hill, Fenwick	2 0 0
SWEET MILK CHEESE.	John D. Boswell of Garallan, Ayr,	Silver Medal.
Do.	1. Wm. Bone, Auchencloigh, Sorn,	L.3 0 0
Do	2. James Leiper, Little Glen, Loudoun,	2 0 0

SEEDS.

The Silver Medal has been awarded to the following :—

The County of Inverness.

1. Evan Logan, Stoneyfield, Inverness, for White Wheat.
2. Alexander Simpson, Teawig, Beauly, for Chevalier Barley.
3. William Cameron, Upper Mackovie, Inverness, for Sandy Oats.
4. James Cameron, Lower Mackovie, Inverness, for Perennial Ryegrass.
5. John Sinclair, Borlum, Glen Urquhart, for Sandy Oats.

* Half Premiums awarded, the number of lots being under six.

The County of Nairn.

1. Robert Anderson, Kildrummy, Nairn, for Chevalier Barley.
2. Robert Anderson, Kildrummy, Nairn, for Angus Oats.

The County of Forfar.

1. Patrick Webster of Westfield, Forfar, for English Barley.
2. David Bell, Mains of Brigton, Forfar, for Potato Oats.
3. S. T. M. Hood, Pitcur, Coupar-Angus, for Cheddam Wheat.
4. Robert Fairweather, Craigend, Brechin, for Perennial Ryegrass Seed.

GREEN CROPS ON SMALL POSSESSIONS.

The Parishes of Kenmore and Killin.

1. John M'Laren, Machuim,	L.3	0	0
2. Peter Stewart, Craganester,	2	10	0
3. John Cameron, Bridge of Lochay,	1	10	0
4. Peter Sinclair, Margnacranaig,	1	0	0

MANAGEMENT OF REAPING-MACHINES.

The Silver Medal was awarded to Peter M'Donald, Inchmichael, at a Competition held at Inchture.

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Silver Medal has been awarded to the following parties:—

Forbes and Fordyce Association.

George Henderson, Towie, for Bull.

Peeblesshire Association.

Charles Tennant of Glen, for Short-Horn Cow.

Dunoon Society.

Thomas Lawson, Carlarach, Innellan, for Cheviot Ewes.

Penicuik Society.

John Wilson, Crosshouse, Roslin, for Leicester Tup.

Western District of Mid-Lothian Association.

John Meikle, Jr., Seafield, Livingstone, for Ayrshire Bull.

Mauchline Society.

William Bone, Auchencloigh, for Best-managed Dairy.

Bute Society.

Alexander Hunter, St Colmac, for Best-managed Green Crop.

Clackmannanshire Union Society.

W. Wingate, Longcarse, Alloa, for Best Green Crop on *Carse Farms.*
James M'Ewen, Muircot, Tillicoultry, for Best Green Crop on *Dryfield Farms.*
John Peat, Manor, Stirling, for Best-made Hay.

East Kilpatrick Society.

Alexander Buchanan, Garscadden Mains, for Best-managed Farm.
Alexander Buchanan, Garscadden Mains, for Best-managed Green Crop.

District of Breadalbane.

Colonel Murray, Moness, for Best-managed Green Crop.
John M'Dougall, Kinnigallin, for Best-kept Dunghill.

Lauderdale Society.

Thomas Swinton, Whiteslaid, for Hedge-Cutting.

PLOUGHING COMPETITIONS.

In the course of the year the Society's Medal was awarded at 131 Ploughing Competitions, the details of which are given in a previous part of this volume.

COTTAGES AND GARDENS.

FOR THE BEST-KEPT COTTAGES AND GARDENS.

First Cottage Premium—L.1, 5s., and Medal when Four Competitors; Second,—L.1; Third,—15s. First Garden Premium—L.1, 5s, and Medal when Four Competitors; Second,—L.1; Third,—15s.

FORGUE.—1st Cottage Premium and Medal to Gordon Campbell; 2d, to Mrs Simpson; 3d, to Mrs Con. 1st Garden Premium and Medal to Adam Charles; 2d, to Wm. Dyce; 3d, to John Greig.

FALKLAND.—1st Cottage Premium and Medal to Alexander Walker; 2d, to Frederick Wilkie; 3d, to James Simpson. 1st Garden Premium and Medal to David Bruce; 2d, Frederick Wilkie; 3d, Alexander Walker.

NEWBURGH.—1st Premium and Medal to Matthew Fotheringham; 2d, to James Barclay; 3d, to David Laurie.

COVINGTON.—1st Cottage Premium and Medal to William Purdie; 2d, to James Wood; 3d, to Thomas Porteous. 1st Garden Premium and Medal to James Forrest, Sen.; 2d, to Adam Henderson; 3d, to James Hood.

ST MARTINS.—1st Cottage Premium and Medal to Mrs Manson; 2d, to Misses Mackenzie; 3d, to William Herd. 1st Garden Premium and Medal to David Stewart; 2d, to William Herd; 3d, to James Wells.

KIRKCOLM.—1st Cottage Premium to Robert Nisbet.

MEDALS GIVEN IN AID OF PRIVATE COMPETITIONS.

Newburgh Society.

James Anderson, for Best-kept Cottage Garden.

Mauchline Society.

Thomas Wilson, Jr., for Best-kept Cottage Garden.

Parishes of Alvah and Forglen.

William Skene, Hill of Alvah, for Cottage and Garden.

VETERINARY COLLEGE.

Silver Medals were awarded, at the annual examination in April last, to the following parties:—

1. Thomas Taylor, Manchester, for best general examination.
2. Thomas Taylor, Manchester, for best examination in Horse Pathology.

3. C. Cunningham, Slateford, } for best examination in Cattle Pathology.
4. G. Smith, Karesbrough, }
5. David Paley, Ryhill, Yorkshire, } for best examination in Anatomy.
6. H. Thompson, Carlisle, }
7. Thomas Skea, Dublin, for best examination in Physiology.
8. James N. Haslam, Salford, Manchester, for best Anatomical Preparation.

All Premiums not applied for within two years from the 1st of January last will be forfeited.

By order of the Directors,

JN. HALL MAXWELL, *Secretary.*

EDINBURGH, 10*th February* 1860.

PROCEEDINGS IN THE LABORATORY.

By PROFESSOR ANDERSON, M.D., Chemist to the Society.

ON THE COMPOSITION OF THE TURNIP AT DIFFERENT PERIODS OF ITS GROWTH.

THE length of time different crops require to arrive at maturity is well known to differ exceedingly; and the contrast between the tardy growth of the wheat plant and the rapid vegetation of the turnip is sufficiently striking. If the comparison between these two crops be carried out still further, and extended to the large quantity of vegetable matter produced by the latter, and the comparatively small amount by the former, it is impossible to doubt that there must be a most important difference between their vegetative conditions. During the long period of its growth, time is allowed for the wheat plant to draw its nutriment gradually and slowly from the soil and air, and yet the absolute quantity it appropriates is not large. The turnip, on the other hand, is not only restricted to a much more limited period of growth, but manages, within that time, to assimilate a much larger quantity of those elements required by all plants, and which the soil contains in what is at least a comparatively small proportion. It cannot be doubted that this difference must be of much importance in a practical point of view, and, when fully considered, it opens up many questions regarding the nature of the soil, the conditions in which its constituents are present, and its effect on the progress and amount of different crops. It is readily conceivable that soils may exist which contain the greater part of their constituents in the form of compounds not available to plants, and which are so little amenable to

those decompositions by which they are set free in suitable condition, as to afford, at any one time, a very limited supply of plant food. On a soil of this description, wheat, owing to the longer time it has to assimilate its food, may afford a good crop; while the turnip, which demands a larger supply within a shorter time, may fail to obtain what is necessary to its unrestricted growth, and consequently yield a very poor return. The fact that a difference of this kind must necessarily exist has been often remarked; but the subject has not hitherto been investigated with the minuteness necessary to admit of practically useful conclusions being drawn from it. It is clear that the question cannot be fairly solved by a comparison of the total mineral matters withdrawn from the soil by any crop, and its entire time of growth; but it is necessary to take into consideration the rapidity with which the elements of its food are assimilated at different periods of its existence. It is obvious, for example, that winter wheat makes a very tardy progress during the first few months after it is sown, and at the approach of spring bursts into active life; and it is perfectly possible that, at a particular part of its progress, its growth may be so rapid, that during that time it may actually require more food than would have been necessary for the turnip. Under such circumstances, the conditions, as between these two crops, might be entirely reversed, and the more equable progress during the whole growth of the latter might more than counterbalance the length of time consumed in passing through the earlier stages of the existence of the former. In fact, the produce obtained from any crop must be measured by the maximum, and not by the average demand which it makes upon the soil; and unless the substances it requires are supplied to it in an available condition, and in adequate quantity to meet this maximum demand, the crop must necessarily fall short, even though its earlier progress may have been all that could be expected.

In order to obtain information on these points, it would be necessary to examine the crops in such a manner as to ascertain their composition, and the amount of produce at different periods of their growth. An inquiry of this kind cannot therefore be confined merely to the laboratory, but must be partly carried out in the field, and be at once an agricultural experiment and a chemical investigation. It consequently becomes a very laborious matter, and requires much attention and many precautions, and, if extended to all the principal crops of the farm, would occupy the time of an active chemist for many years. Although fully aware of the extent and difficulty of the subject, I have long been anxious to commence its investigation; but many circumstances have hitherto prevented my doing so, among which not the least was the difficulty of obtaining a piece of ground on which to make the experiments. It was, therefore, with the greatest satisfaction

that I availed myself of the opportunity afforded me by my friend and former pupil, Mr G. Brown, of Oxgang, near Kirkintilloch, to make a series of experiments on the turnip crop, which form the subject of the following paper.

The field on which the experiments were made lies on the banks of the Luggie, about one and a half miles from Kirkintilloch. It consists principally of a long flat lying along the river, and at its upper part gradually rises upwards, forming a somewhat steep slope. It had lain in grass for many years, and, owing to want of drainage, the pasture was sour and inferior. It had never been much cultivated, as the water lay long on the furrows in spring, and thus prevented sowing; and the crop, being late, was liable to damage in autumn from the overflowing of the river. After having carried a very indifferent crop of oats, the field was drained three feet deep, and twenty-one feet apart, in the autumn of 1858, and limed to the extent of four tons per acre. The soil being thus almost in its natural condition, was particularly well adapted for experimental purposes.

It is a light sandy loam, very uniform throughout the field, and, on the whole, of rather moderate quality, but well suited to the turnip. Previous to the liming and manuring it was analysed, and its composition in 10,000 parts found to be as follows:—

Soluble in water.	Organic matter,	5.53
	Peroxide of iron,	0.37
	Lime,	0.36
	Magnesia,	0.49
	Potash,	1.25
	Chloride of sodium,	2.91
	Phosphoric acid,	0.72
	Sulphuric acid,	4.43
	Silicic acid,	8.02
		24.08
	Peroxide of iron,	427.02
	Alumina,	260.15
	Lime,	33.77
	Magnesia,	27.71
	Potash,	221.05
	Soda,	3.48
	Chloride of sodium,	20.66
	Phosphoric acid,	87.77
	Sulphuric acid,	5.94
	Silicic acid,	52.68
	Organic matter,	576.61
	Insoluble silicates,	7985.62
	Moisture,	823.02
		9999.74

In a chemical point of view, therefore, the soil is a good one, and contains a suitable proportion of all the necessary elements of plants, and is particularly rich in potash.

The field was manured with twenty tons good farmyard manure per Scotch acre, and the turnip, which was of the Aberdeen purple-top variety, was sown in the first week of June. The weather being favourable, the crop brairded satisfactorily, and was thinned on 7th July, and it was then that my experiments commenced. A quantity of the thinnings was taken for analysis, which was conducted in the manner hereafter to be described. The field was then carefully gone over, and the state of the crop examined, and a portion, which was considered to give a fair average of the whole, was selected for further experiment. One-eighth of a Scotch acre was then accurately measured off, and the number of plants growing on it was counted. They were found to amount to 2998, or 23,984 per acre. As, however, this number approached very closely to 24,000, I have assumed the latter as the average number of plants per acre, by which no appreciable error is introduced; and the calculations, which are of a very troublesome and laborious nature, are materially facilitated.

FIRST STAGE OF GROWTH AT THE PERIOD OF THINNING—7TH JULY.

A quantity of the thinnings was taken to the laboratory for analysis, and one hundred plants being taken at random from the heap, the rootlets were carefully separated from the leaves, and both weighed, with the following results—

Leaves of 100 plants,	8007.6 gr.
Rootlets,	272.5 „
Weight of 100 plants,	8280.1 „

Giving for the average weight of each plant 82.8 grains, and for the total weight of the 24,000 plants on the acre 288.88 lb., which is divided between the leaves and bulbs in the following proportions:—

Leaves,	274.55 lb
Rootlets,	9.33 „
	283.88 „

The leaves and rootlets were then separately submitted to analysis. The portions taken for this purpose were carefully separated from adhering soil. The leaves were found to contain per cent—

Water,	92.08
Albuminous compounds,	2.51
Other organic matters,	4.79
Ash,	0.62
	100.00
Nitrogen,	0.403

The ash prepared on a large scale had the following composition:—

Peroxide of iron,	2.94
Lime,	12.33
Magnesia,	3.33
Potash,	5.79
Soda,	0.12
Chloride of sodium,	6.34
Phosphoric acid,	6.25
Sulphuric acid,	5.33
Carbonic acid,	7.81
Silicic acid,	5.50
Sand,	42.76
Charcoal,	1.56
	100.06

These numbers, recalculated after deduction of sand and charcoal, stand as follows:—

Peroxide of iron,	5.27
Lime,	22.12
Magnesia,	5.97
Potash,	10.39
Soda,	0.22
Chloride of sodium,	11.38
Phosphoric acid,	11.02
Sulphuric acid,	9.58
Carbonic acid,	14.01
Silicic acid,	9.86
	100.00

One hundred parts of the rootlets contained—

Water,	81.13
Albuminous compounds,	6.31
Other organic matters,	9.22
Ash,	3.34
	100 00
Nitrogen,	0.996

The ash contained—

Peroxide of iron,	3.32
Lime,	7.75
Magnesia,	5 20
Potash,	12.15
Soda,	2.65
Chloride of sodium,	5.32
Phosphoric acid,	7.10
Sulphuric acid,	5.97
Carbonic acid,	6.66
Silicic acid,	5.92
Sand,	34.84
Charcoal,	2.60
	99.48

And the same, calculated after deduction of sand and charcoal, gave—

Peroxide of iron,	5.35
Lime,	12.49
Magnesia,	8.38
Potash,	19.58

Soda,	4.27
Chloride of sodium,	8.58
Phosphoric acid,	11.45
Sulphuric acid,	9.62
Carbonic acid,	10.74
Silicic acid,	9.54
	100.00

In comparing these analyses with one another, we are forcibly struck by the marked difference in the proportions of solid matter in the leaves and rootlets. The latter, which were slender threads, and as yet showed no appearance of expansion into a bulb, present, as we shall afterwards see, a very marked contrast in composition to the mature turnip. At present, however, we must confine our attention to a comparison between the leaves and roots, and it is particularly noticeable that the latter contain nearly two and a half times as much solid matter as the former. As regards the individual constituents, they bear a somewhat similar ratio to one another, with the exception of the ash, which is much larger in the roots.

If now we proceed to determine from the data above given the proportions of the different substances which at this stage of its existence the turnip crop has withdrawn from an acre of land, matters stand as follows, the numbers being expressed in pounds:—

Water,	260.27
Albuminous compounds,	8.80
Other organic matters,	12.81
Ash,	2.00
	283.88

The mineral matters removed are given in grains below: —

Peroxide of iron,	739.2
Lime,	3052.0
Magnesia,	844.2
Potash,	1495.2
Soda,	47.6
Chloride of sodium,	1580.6
Phosphoric acid,	1626.8
Sulphuric acid,	1338.4
Carbonic acid,	1926.4
Silicic acid,	1349.6

And these are divided between the leaves and roots in the following proportions:—

	Leaves.	Roots.
Water,	252.75 lb.	7.52 lb.
Albuminous compounds,	6.63 „	0.56 „
Other organic matters,	13.53 „	0.89 „
Ash,	1.70 „	0.30 „
	274.61 lb.	9.027 lb.
Nitrogen,	1.062 „	0.090 „

	Leaves.	Bulbs.
Peroxide of iron,	627.13 gr.	112.25 gr.
Lime,	2632 28 „	261.19 „
Magnesia,	710.43 „	165 98 „
Potash,	1236.41 „	410.00 „
Soda,	26.18 „	88.67 „
Chloride of sodium,	1353.03 „	180.04 „
Phosphoric acid,	1335.18 „	239.35 „
Sulphuric acid,	1138.83 „	201.02 „
Carbonic acid,	1667.19 „	227.44 „
Silicic acid,	117.34 „	207.06 „

Many important considerations are opened up by these analyses. It appears that, during the early stages of its growth, the progress of the turnip plant is very slow, and the extent of its demands on the soil remarkably small. The total quantity of mineral matters withdrawn by it is only 2 lb., while the organic matters are 21.62 lb., or nearly ten times as abundant. Compared with the mineral matters, the quantity of nitrogen, 1.152 lb., must be considered as remarkably large. It is also obvious that this period has been chiefly devoted to the development of the leaves, the organs by which the plant is afterwards enabled to obtain a certain proportion of its organic nutriment from the air, the weight of the leaves being about thirty times that of the rootlets, and the solid matters in the proportion of 12.5 to 1. It is scarcely necessary to refer at large to the relative proportions of the different inorganic matters, as they can be at once seen by inspection of the foregoing table.

SECOND STAGE.—PLANTS COLLECTED ON THE 11TH AUGUST.

For some time after thinning, the progress of the crop was rather slow, the weather being dry, and somewhat unfavourable in other respects. But in the end of July and beginning of August they advanced rapidly, and on the 11th of the latter month plants were again selected. For this purpose the experimental plot was carefully gone over, and the general appearance of the crop examined, so that a fair average specimen might be obtained. The leaves had now developed so as nearly to cover the drills, and the bulbs varied from the thickness of the thumb up to that of a large egg. Forty plants were taken, and the leaves and bulbs now stood as follows:—

Leaves of 40 plants,	26 lb. 8 oz.
Bulbs,	5 „ 15 „
Weight of entire plants,	32 lb. 7 oz.

Giving for the average weight of each plant almost exactly 13 oz, and for the whole acre 19,407 lb., or 8 tons 13 cwt. 3 qrs. nearly, divided between leaves and bulbs in the following proportions:—

Leaves,	15,911 lb.
Bulbs,	3,496 „
	19.407 „

The leaves were found to contain—

Water,	90.90
Albuminous compounds,	1.84
Other organic matters,	5.38
Ash,	1.88
	100.00
Nitrogen,	0.295

The ash had the following composition :—

Peroxide of iron,	2.30
Lime,	11.70
Magnesia,	5.60
Potash,	13.79
Soda,	2.23
Chloride of sodium,	9.24
Phosphoric acid,	9.85
Sulphuric acid,	12.43
Carbonic acid,	10.44
Silicic acid,	2.42
Sand, Charcoal,	20.83
	100.83

And the same, after deduction of sand and charcoal, gives—

Peroxide of iron,	2.87
Lime,	14.61
Magnesia,	6.99
Potash,	17.22
Soda,	2.78
Chloride of sodium,	11 54
Phosphoric acid,	12.29
Sulphuric acid,	15.64
Carbonic acid,	13.04
Silicic acid,	3.02
	100.00

The bulbs contained—

Water,	89.90
Albuminous compounds,	1.06
Other organic matters.	8.16
Ash,	0.88
	100 00
Nitrogen,	0.170

The composition of the ash was—

Peroxide of iron,	1.92
Lime,	7.30
Magnesia,	3.50
Potash,	27.59
Soda,	8 55
Chloride of sodium,	6.62
Phosphoric acid,	10.43
Sulphuric acid,	7.90
Carbonic acid,	9.40
Silicic acid,	2.19
Sand, Charcoal,	14.82
	100.22

After deducting sand and charcoal the results are—

Peroxide of iron,	2.24
Lime,	8.55
Magnesia,	4.09
Potash,	32.29
Soda,	10.02
Chloride of sodium,	7.76
Phosphoric acid,	12.22
Sulphuric acid,	9.25
Carbonic acid,	11.03
Silicic acid,	2.55
	100.00

During this stage of growth the most remarkable change is that which has occurred to the bulbs, the proportion of dry matter having diminished to little more than half what it was in the first period. The leaves, on the other hand, have gained slightly in this respect. The proportion of nitrogen has likewise undergone a material change, for while at the early stage the rootlets contained much more than the leaves, these proportions are now reversed.

The entire produce per acre calculated from those analyses, is now as follows:—

Water,	17,647 lb.
Albuminous compounds,	322 „
Other organic matters,	1,164 „
Ash,	330 „
	19,464 „

Mineral matters in pounds:—

Peroxide of iron,	9.27
Lime,	46.33
Magnesia,	22.15
Potash,	61.49
Soda,	11.55
Chloride of sodium,	36.89
Phosphoric acid,	40.54
Sulphuric acid,	49.66
Carbonic acid,	42.42
Silicic acid,	9.82

And these are divided between leaves and bulbs in the following proportions:—

	Leaves.	Bulbs.
Water,	14,463	3,184
Albuminous compounds,	281	41
Other organic matters,	968	196
Ash,	299	31
	15,991	3452
Nitrogen,	45	6.6
Peroxide of iron,	8.58	0.69
Lime,	43.68	2.65
Magnesia,	20.89	1.26

Potash, .	51.48	10.01
Soda, .	8.33	3.12
Chloride of sodium,	34.49	2.40
Phosphoric acid,	36.76	3.78
Sulphuric acid,	46.78	2.88
Carbonic acid,	38.98	3.44
Silicic acid,	9.03	0.79

During this period of its growth it appears, therefore, that the progress of the turnip had suddenly become exceedingly active; for, in the course of the thirty-four days comprised within it, the crop had taken up, per acre, no less than 1816 lb. of solid matters. This is at the rate of 53.4 lb. per day, so that its daily advance now exceeded twice that it had made during the whole thirty days which elapsed between sowing and thinning. The increase, however, is most remarkable in the bulbs, which have increased in a far higher ratio than the leaves, because, while at the end of the first period the solid matter contained in the leaves weighed 12.5 times as much as that in the bulbs, the ratio is now as 4.5 to 1; and when the comparison is made between the actual weight of the crop in the two conditions, the difference is still more remarkable. In short, the development of the bulbs has now commenced, although their weight is still small when compared with that of the leaves. It is to be noticed that this change is likewise accompanied by a marked increase in the proportion of water contained in the bulbs, and by a very great diminution in the proportion of albuminous matters, which have fallen from upwards of 6 to nearly 1 per cent. The change in composition of the ash is not very great. In the case of both leaves and bulbs it is chiefly characterised by the diminution of the quantity of lime and increase of potash.

THIRD STAGE OF GROWTH.—PLANTS COLLECTED ON THE 1ST SEPTEMBER.

The progress of the crop during the previous period having been so exceedingly rapid, it was thought better to allow a shorter period to elapse between the analyses, and accordingly a new supply was collected on the 1st September. The plot was again carefully gone over, and the general state of the crop examined, so that a fair sample might be taken. As its bulk had greatly increased, twenty plants only were taken, and they were selected with great care, so as to give a fair average of the whole. Their weight was—

Leaves, ...	20 lb.
Bulbs, ...	15 ,,
Weight of twenty plants, . .	35 ,,

Giving for the average weight of each plant 1 lb. 12 oz., and for the whole acre exactly 42,000 lb., or 18 tons 15 cwt., which was divided between leaves and bulbs as follows:—

Leaves,	24,000
Bulbs,	18,000
	42,000

The analysis of the leaves gave the following results:—

Water,	89.10
Albuminous compounds,	0.76
Other organic matters,	8.19
Ash,	1.95
	100.00
Nitrogen,	0.121

The ash contained—

Peroxide of iron,	1.85
Lime,	10.64
Magnesia,	6.02
Potash,	19.00
Chloride of sodium,	12 20
Phosphoric acid,	8.53
Sulphuric acid,	10.49
Carbonic acid,	10.56
Silicic acid,	2.23
Sand and charcoal,	19.13
	100.75

And after deduction of sand and charcoal—

Peroxide of iron,	2.26
Lime,	13 05
Magnesia,	7.39
Potash,	23.30
Chloride of sodium,	14.96
Phosphoric acid	10 46
Sulphuric acid,	12.88
Carbonic acid,	12.96
Silicic acid,	2.74
	100.00

The bulbs contained—

Water,	90.020
Albuminous compounds,	1.400
Other organic matters,	7.555
Ash,	1.025
	100.00
Nitrogen,	0.224

And the composition of their ash was—

Peroxide of iron,	1.14
Lime,	7.03
Magnesia,	3.29
Potash,	24.00
Soda,	4.13
Chloride of sodium,	7.37
Phosphoric acid,	9.11
Sulphuric acid,	13.71
Carbonic acid,	10.10
Silicic acid,	2.25
Sand and charcoal,	18.20
	100.88

And after deduction of sand and charcoal—

Peroxide of iron,	1.39
Lime,	8.55
Magnesia,	4.00
Potash,	29 21
Soda,	5.02
Chloride of sodium,	8.97
Phosphoric acid,	11.09
Sulphuric acid,	16.68
Carbonic acid,	12.36
Silicic acid,	2.73
	100.00

Little difference is to be observed between the per-centage results of the analyses of these samples and the last. The most remarkable point is, that the proportion of albuminous matters in both leaves and bulbs has diminished; and hence it must be inferred that the assimilation of the non-nitrogenous matters has been more active than that of the nitrogenous. The proportion of ash, and of its different constituents, may be said to be almost identical with that which they presented at the previous period.

The entire produce per acre now amounted to—

Water,	37,582.0 lb.
Albuminous compounds,	431 0 „
Other organic matters,	3,334.5 „
Ash,	652.5 „
	42,000.0 „
Nitrogen,	69.1
Peroxide of iron,	13.14
Lime,	76 83
Magnesia,	41 96
Potash,	162.93
Soda,	9.26
Chloride of sodium,	86.55
Phosphoric acid,	69.40
Sulphuric acid,	91.05
Carbonic acid,	83.44
Silicic acid,	17.94
	652.50

These constituents were divided between the leaves and bulbs in the undernoted proportions, in pounds—

	Leaves.	Bulbs
Water,	21,382	16,200.
Albuminous compounds,	156	275.
Other organic matters,	1,994	1,340.5
Ash,	468	184.5
	24,000	18,000
Nitrogen,	28.7	40.4
Peroxide of iron,	10.57	2.57
Lime,	61.06	15 77
Magnesia,	34 58	7.38
Potash,	109.04	53.89

Soda,	...	9.26
Chloride of sodium,	70.00	16.55
Phosphoric acid,	48.94	20.46
Sulphuric acid,	60.27	30.78
Carbonic acid,	60.64	22.80
Silicic acid,	12.90	5.04
	468.00	184.5

During this last period of twenty days, it is to be observed that the bulbs have again advanced in a more rapid ratio than the leaves, although the latter still form the larger proportion of the crop. The total amount of solid matters withdrawn from the soil during these twenty days has amounted to 2602 lb., being at the rate of 130 lb. per acre per day. The rate of increase, therefore, is nearly two and a half times as great as it was during the preceding period, and the bulbs have gained in a more rapid ratio than the leaves, the quantity of solid matters accumulated by the former having been 1440 lb. It is interesting also to notice that this period is distinguished especially by a proportionately more rapid increase of organic matters, which have advanced to about two and a half times their former quantity, while the inorganic or mineral matters are rather less than double. As far as the individual constituents of the ash are concerned, the most notable point is the rapid accumulation of alkalies, and more particularly of potash, which has increased almost exactly in the proportion of solid matters, while phosphoric acid is only a half more than it was at the end of the last period.

Fourth Stage.—Plants collected on 5th October.

A new supply of plants was taken on the 5th October, after some rather unsettled weather. On this occasion twelve plants were taken with great care, so that they might fairly represent the general bulk of the crop. They consisted of—

Leaves,	7 lb.
Bulbs,	23 „
Weight of plants,	30 „

Giving for the average weight of each turnip plant 2½ lb., and for that of the entire crop per acre 60,000 lb., or 26 tons 15 cwt. 3 qrs., and this consisted of leaves and bulbs in the following quantities:—

Leaves,	14,010
Bulbs,	45,990
	60,000

The leaves were found to contain—

Water,	88.45
Albuminous compounds,	2.40
Other organic matters,	7.27
Ash,	1.88
	100.00
Nitrogen,	0.385

The analysis of the ash gave—

Peroxide of iron,	1.71
Lime,	4.82
Magnesia,	9.80
Potash,	11.05
Chloride of sodium,	12.71
Phosphoric acid,	8.08
Sulphuric acid,	9.94
Carbonic acid,	10.52
Silicic acid,	2.56
Sand and charcoal,	29.00
	100.39

And after deduction of sand and charcoal—

Peroxide of iron,	2.67
Lime,	6.76
Magnesia,	13.73
Potash,	15.47
Chloride of sodium,	17.81
Phosphoric acid,	11.32
Sulphuric acid,	13.93
Carbonic acid,	14.73
Silicic acid,	3.58
	100.00

The bulbs had the following composition :—

Water,	90.50
Albuminous compounds,	1.18
Other organic matters,	6.33
Ash,	1.99
	100.00
Nitrogen,	1.63

The ash contained—

Peroxide of iron,	1.02
Lime,	8.98
Magnesia,	3.69
Potash,	20.77
Soda,	5.05
Chloride of sodium,	7.12
Phosphoric acid,	7.53
Sulphuric acid,	9.69
Carbonic acid,	7.96
Silicic acid,	2.30
Sand and charcoal,	26.12
	100.23

And after deduction of sand and charcoal—

Peroxide of iron,	1.37
Lime,	12.12
Magnesia,	4.97
Potash,	28.03
Soda,	6.82
Chloride of sodium,	9.61
Phosphoric acid,	10.16
Sulphuric acid,	13.07
Carbonic acid,	10.74
Silicic acid,	3.11
	100 00

In these analyses the proportions of the different ingredients do not differ to any marked extent from those of the previous period, except in the albuminous compounds, which have increased to some extent, more particularly in the leaves.

The total produce per acre has, however, again undergone a marked increase, and amounted to—

Water,	54,013.	lb.
Albuminous compounds,	750.	„
Other organic matters,	4,056 6	„
Ash,	1,180.4	„
	60,000.0	„

Peroxide of iron,	19.62
Lime,	128.95
Magnesia,	81 74
Potash,	297 79
Soda,	62 54
Chloride of sodium,	135 03
Phosphoric acid,	122.99
Sulphuric acid,	156 58
Carbonic acid,	137.28
Silicic acid,	37.93
	1180.4

(*To be continued.*)

ON BREEDING AND REARING CATTLE.

By HENRY TANNER, Professor of Agriculture, Queen's College, Birmingham.

[Premium—The Gold Medal.]

THIS subject is invested with deep interest, for it involves one of the most important branches of agricultural industry. Errors are often multiplied and perpetuated, and consequently must be more jealously avoided. The management of breeding cattle claims our most careful attention, because not only are the sources of remuneration from many districts chiefly dependent upon it, but the profits of every farm are, in a greater or less degree, under the influence of the system adopted, whether good or bad. I shall at once proceed to notice those points which appear to me to be of the greatest importance, and which I believe to be worthy of consideration in Breeding and Rearing Cattle.

I need scarcely stay to remark that, by the process of domestication, our breeds of cattle have undergone great change of form, both externally and internally; so much so, indeed, that there is scarcely any part of the animal which has not yielded to the change of circumstances which has resulted from their being brought under the care of man. The deviations from the standard character of our wild breeds only continue so long as they are kept under this artificial system, for we find that as a more neglectful course of management is adopted, so the original character of the wild animal will again be developed. Hence the peculiar conformation of our improved breeds of cattle must not be looked upon as any permanent modification of form, but as entirely dependent upon their being continued under the same system by which the change was originally produced.

The characteristic points possessed by cattle in a state of nature are all eminently adapted for the preservation and perpetuation of the species, for Nature is perfect in all her details. Under our artificial system, we require certain modifications which are better adapted to our requirements. For instance, instead of having an animal almost destitute of fat, which is the condition of our wild breeds, we desire a fuller development of this material, together with a more tractable disposition; but to attain these results we have to alter the entire system of the animal. It does appear extraordinary that man should have such control over the animal race, but experience teaches him how to accomplish the desired result. We cannot accomplish this without the aid of Nature, and it is chiefly done by adopting two simple principles—1st, That

the development of any part is promoted or checked by the degree of exercise which that part may have; and, 2dly, That under similar conditions like produces like.

To illustrate these points more fully, I shall state as briefly as possible the principal changes which are observed in our improved breeds of cattle. I do so as concisely as possible, because I conceive it is desired that the report should be restricted as much as possible to the management of breeding cattle, and not extend to the more general treatment of cattle.

If we take either of our improved breeds of cattle, and examine one individual of the class, we shall find that there is a marked difference in the general outline of the body. The wide and deep chest, the roundness of the barrel, and the full development of muscle and fat over the body, give the improved animal a certain squareness of outline which is totally at variance with any specimen of the original breed. Nor does the difference end here, for the internal conformation presents peculiarities of which the external form may be taken as a constant indication. The lungs and liver are found to be considerably reduced in size when compared with those possessed by animals having perfect liberty. The cause is evident, and admits of easy explanation. In a state of nature the animal is accustomed to violent exercise, and this brings the lungs into active work, and the result is a full development of the part. But suppose another animal of the same breed, kept in a very confined space the greater part of its life, the lungs, not having been equally exercised, would not be as fully developed. The progeny from this animal would also possess a tendency in the same direction; and if such an offspring were kept in a state of confinement, it would probably possess even smaller lungs than its parent. Thus the restricted exercise of our cattle has produced and perpetuated a small development of this part of the body. The same results are observable in the liver in an equal degree with the lungs; for similar active exercise induces increased energy in the liver, whilst the luxurious life of the improved animal produces a torpid and inactive liver.

Thus we observe that domestication has modified the development of the lungs and liver, and hence the functions they perform are proportionately diminished. It is well known that the food which an animal consumes chiefly consists of two classes of bodies—those which form muscle, and those which maintain the heat of the body. It is the latter class to which we must now refer. The heat of the body is maintained by the combustion of the carbonaceous matter of the food. Combustion is not necessarily attended by that manifestion of flame which is generally observed; but the same change and the same results may be produced in a much more gentle manner. This change actually takes place in the animal body, and the carbonaceous matter of the food under this action

yields to the body the heat which is necessary for the healthy discharge of its functions.

The blood, on passing through the body, bears with it the heat-giving matter of the food, and also carries other important chemical agents in its colouring matter; when these bodies come together, a change takes place and heat is produced. Now this change does not take place to any great extent in the arteries, but it is whilst the blood is passing through the capillary vessels, which pervade every portion of the body, that the action is rendered complete, and thus these vessels not only carry nourishment for the support of the system, but also distribute an equable supply of warmth.

It is clear, then, that the larger the lung the more fully does the body receive the oxygen which is to develop heat in the body; and the natural result is, that a more perfect combination of the carbonaceous matter of the food takes place. Fat is composed of the same materials as are thus used for keeping up the heat of the body, and, consequently, the more there is used in this way, the less remains for being stored away as fat. Thus large lungs are prejudicial to the formation of fat.

We may here observe that food may be very much economised by being consumed by "high-bred" animals; but it must be added that there are other attendant circumstances which act prejudicially. We may modify the operations of Nature; but she, with jealous care, guards these alterations, and continually places obstacles to check, and frequently to prevent, the perpetuation of the *unnatural* conditions which we desire so much to produce. These difficulties are constantly arising in breeding from animals of this class, and we shall subsequently have occasion to notice this fact.

With these introductory remarks I will proceed to the practical portion of this subject, and in it we shall find the principle thus briefly noticed more fully illustrated. It will be convenient to notice this subject under the following divisions:—

The Management of Cattle before Breeding.
... ... whilst Breeding.
... ... after Calving.

THE MANAGEMENT OF CATTLE BEFORE BREEDING.

In treating of this subject we are naturally led back to the period of the calf's birth, and we cannot do better than trace its course through life. A great difference of opinion exists upon the best and most advantageous course to be pursued, and in various localities different systems are adopted. There are two modes of rearing calves; either the calf is removed from the cow immediately after birth and reared by hand, or else the calf is allowed to suck the cow. The peculiar circumstances of different farms may lead us to

modify our course; but before commenting upon these various practices, it may be desirable to state them more fully.

In those cases in which the calf is never allowed to suck the cow, it is removed immediately after its birth, and, having been placed in a separate building, is well rubbed with straw. After a few hours, the first milk of the cow (generally called the beastings) is carefully given to the calf. This is best done by supporting the head on the hand, and allowing the milk to run gently into the mouth. This method is preferable to the more usual plan of making the calf suck from below. Indeed, for a few days it is better to supply the animal in this manner. Warm milk is the only food the young calf receives for about three weeks, and during this time it ought to be fed three or four times a-day. A strong healthy calf will take from 8 to 10 quarts daily.

The calves are gradually trained to eat sliced turnips and linseed cake. The general plan is to put a bit of cake into the calf's mouth immediately after taking its milk, when it will continue to suck and dissolve the cake. When about six weeks old the same quantity of milk is given at two meals instead of three, and at noon some other food can be given. This will be chiefly cut roots, hay, and crushed cake. These are gradually increased in quantity as the calf is able to consume larger quantities, and the milk is decreased proportionately. When the calf is first put out to grass for a few hours, the house food is steadily decreased, so that it may be prepared for grass food when turned out for the summer grazing. The advantages of this method are the economy of milk, and its division amongst the calves according to the discretion of the feeder.

The second plan differs from the above in the calf being allowed to suck the cow for the same length of time, instead of the milk being drawn and given to it. When this plan is adopted, the calf is not removed after birth, but is allowed to remain beside the cow, and she soon dries it by the natural process of licking, which at the same time encourages the circulation of the blood throughout the body of the young animal, and acts as a purgative on the cow. Within a few hours the calf will probably be strong enough to stand and suck, but if not it must be assisted. Should there be great weakness, a little milk should be drawn and put into the calf's mouth at intervals, until it gains strength. Generally it is kept in a crib within a short distance, and allowed to run to the cow on her being brought into the homestead. In too many cases the calf only receives its food morning and evening; but the mid-day meal is much to be desired, and should always be allowed, for the little additional trouble is well compensated by the progress of the calf.

If the cow is an ordinary milker, she will have more milk than

the calf requires, and many adopt the plan of letting one cow rear two calves; or if this is not done, the milk which the calf does not require is drawn from the cow by hand. If, however, the cow is an inferior milker, she will do but little beyond supplying her calf, and, in some cases, afford it only a bare sustenance. When such is the case, the cow must have food given her to promote the formation of milk of good quality—such, for instance, as oil-cake. When a cow is rearing two calves, we frequently observe that the one being the fastest feeder gets the lion's share of the milk, whilst the other has only a spare allowance. This must be overcome by allowing the weaker one to have the start of the other in commencing its meal—unless it appears that the cow's milk is insufficient for both of the calves, in which case give the cow richer food.

The course of practice is modified by some breeders, who, after allowing the calf to suck ten days, allow it 6 or 8 pints of new milk twice daily, and after this has been continued two or three weeks, *gradually* substitute *skimmed* milk for the new milk, adding oatmeal porridge, and allowing the calf cut roots and hay until it is ten weeks old, when the milk is entirely stopped. Other breeders, when the new milk is removed, use as a substitute ¼ lb. crushed linseed, ¼ lb. bean meal, ¼ lb. molasses, daily, made into 8 or 10 quarts of soup. And this is decidedly a good artificial food for calves.

The stomachs of all ruminating animals—and cattle are of this class—it is well known, differ from those possessed by other animals, in consisting of four compartments, or stomachs, instead of only one. In the calf these stomachs are not fully formed—in fact, one only is intended for action at this period of life, and the other three are but slightly developed. The stomach which the calf possesses is the true digesting stomach, and this is the only one which ought to be brought into play during the period it is living upon milk. Unfortunately, however, it frequently happens otherwise; especially in cases where the calves, from rapid drinking, have the rumen brought into action prematurely.

The process of digestion in the calf is invested with much interest, because it illustrates the simplicity, and at the same time the perfection, of all the functions of life for accomplishing the object in view. It devolves upon food to assist in building up the body of the young animal; hence it should supply all the materials required for forming the various parts of the body. These parts consist of muscles, sinews, nerves, fat, membranes, arteries, veins, bones, &c.; and is it possible that in milk we have all the requisite elements present? Yes; we learn from daily observation that such is the case, and a knowledge of the composition of milk confirms and explains the fact. The following analysis of cows' milk has been given by Chevalier and Henry :—

Casein,	4.48
Butter,	3.13
Milk sugar,	4.77
Saline matter,	.60
Water,	87.02
	100.00

In this food we have the saline matter required for the growth of the skeleton, the casein for the production of the muscles and various organs of the body, together with the butter and milk sugar, which are prepared to furnish warmth and fat to the body. As soon as the milk passes into the stomach of the calf, a fluid called *the gastric juice* is thrown off from the coats of the stomach, in a manner somewhat similar to perspiration from the skin. This gastric juice is of an acid character, and immediately curdles the milk; for it combines with the soda holding the casein in solution, and immediately the curd is separated. Thus we have the same change immediately produced which we observe in milk which has been kept for a long period and allowed to become sour. This curdling of the milk is rapidly followed by a decomposition of its several parts, which pass into the blood and nourish the system.

Thus the internal organism of the calf points to the use of milk *alone* for the early period of its life, and a careful observation of the most successful practice tends to confirm this opinion. For the same reason we may also learn another lesson from the natural habits of the animal—that the supplies of food should rather be moderate and frequent, than larger in quantity after longer intervals. In this respect there is a great difference in the general practice of feeding the calf which is separated from the cow, as compared with others which are not taken away. We find that calves which run with the cow thrive better than others, because they can draw their supplies of milk frequently and in small quantities—in fact, at such times as they feel the want. The stomach of the calf is small, and when the process of digestion is vigorous, the food which it can contain is soon used for the support of the system, and consequently a period of want often intervenes before the fresh supplies are received. This does not arise when the calf has a freedom of access to the cow, for immediately the desire for food commences it can get a further supply. No doubt it may be questioned whether this is an economical method, and one desirable for general adoption; but there are cases which render such a course absolutely essential to success, and I believe in many other cases the question of economy is too often viewed under the contracted aspect of present cost rather than future return.

In rearing a calf there is one object to be kept steadily in view, and that is, to promote the development of the body as much as possible. In the calf which is to be fattened and killed no one will dispute it, and I believe it will be equally important in the case of

those which are to be reared for beef, but it is still more important in rearing breeding stock. From the period of birth this development should be progressive, not interrupted by checks from poor and insufficient food, to be followed by better allowance for a time, and thus only alternating its progress and relapse. When high-bred stock are to be reared, a very different system from this is adopted. In fact, if it were not so, they would rapidly degenerate. In rearing these calves, they follow the natural course of allowing the calf to run with its dam, or else let it have frequent access to her, whilst at the same time she is fed with oil-cake to give richness to the milk. This is the system which is most calculated to produce the best results. The use of artificial food for the calf is carefully avoided in its early stage, but when it is desirable to force the young animal into a more rapid growth, the supplies of artificial food may be given through the medium of the cow. In this manner similar benefits will result, without any prejudicial influence upon the stomach of the calf.

We now come to consider how far such a system is economical or otherwise, and my own impression is, that a liberal system of feeding is always desirable, and that it is not as extravagant a plan as it is frequently thought to be. The object must be kept steadily in view. If *milk and butter* are to be the marketable articles, and they are to have the preference, by all means let everything else yield. If, however, the object is to produce *good stock*, then the butter must yield the supremacy, and the stock take the lead. Many, however, do not like this, and want to have the supplies ot butter and good stock as well. But this cannot be. They are antagonistic claimants, and one or the other must be placed in the rear. On many farms a preference will be given to the butter, but every one should clearly keep in view the main object he is aiming at, and let him not for a moment believe that he is going to sell his full quantity of butter, and yet have his stock improved, unless he adopts a judicious and liberal system of feeding.

Few who have not especially noticed this point will be disposed to credit the real difference in value between two calves (say eight or ten weeks old) reared under the different plans referred to. I do not simply refer to their worth as determined by weight, but, if I may use the term, their prospective value. The difference between them is marked as regards their subsequent progress, and some pounds may separate their value when two or three years old, provided both are carried on from their present age upon an equal and liberal system of feeding. We have not simply to look at the weight of veal, but rather to the *kindly disposition* induced in the animal, which always shows itself by a tendency to thrive.

When a farmer is rearing steers for the purpose of producing a certain weight of beef, this tendency to thrive and *lay on flesh* is valuable; and during the whole course of life this ultimate object

will be most economically promoted by a liberal system of feeding; not variable, which must produce checks, but regular and progressive. In fact, such an animal should never be stationary, for not only is the animal at such a time producing no profitable return, but it is actually decreasing in value.

It is, I believe, not only of equal, but of even greater importance in the case of those animals which are reared for breeding purposes. These are to be viewed as the *parents* of others, and thereby good or bad qualities become multiplied. If it is objectionable in the case of animals intended for the butcher, it is important in a far higher degree for those which are *to produce them*, and which are to give them a conformation and tendency favourable to this end. The law of like producing like is of very general application, and we must not expect a cow without any tendency to fatten, to convey to her offspring a disposition she does not possess. I am well aware that the character of the bull will have influence here, but it will be favoured or checked by the qualities of the dam. We must not consider that because the primary object in rearing cattle for breeding purposes is not simply for the production of beef, that therefore this may be altogether disregarded.

If we seek the best method of rearing a calf, we cannot do better than follow the course pointed out by nature, and allow it to suck its dam, either having frequent opportunities of access to her, or else freedom to run with her. If the calf is intended for veal, it will be preferable to keep some restraint upon the freedom of the calf, but if it is to be reared for stock, moderate exercise will be beneficial. Many calves are kept in small cribs, about four feet square, each being furnished with a little trough, so as to induce the calf to learn to eat artificial food and hay. In other cases each calf is fastened by a strap and a small halter, so as to prevent its running about. The former plan is undoubtedly a good one, if the calf is separated from its dam, because it allows of a freedom of exercise, but the supplies of food for the first three or four weeks are objectionable. It is better to give the cow extra food if the calf is not making sufficient progress, and it will be ample time after the third or fourth week, for the calf to commence the use of solid food. Fastening the calf by a strap, and keeping it in the dark, may be desirable for a fatting calf, but would not be adopted for store stock. When the calves are six weeks old, they should have a larger space for exercise, and several may be allowed to run together with advantage.

When the calf is intended to run with its dam, both should have shelter during inclement weather, and the cow should have her surplus milk drawn at regular intervals. When a calf of choice character and breed is to be reared, it has been recommended that, should the milk of the cow prove deficient—as is too often the case with cattle which are very high bred—that the calf be

suckled by another milch cow possessing better milking character. This would, of course, be seldom done except with valuable stock, but in such a case it is desirable, and the benefit will soon be observable in the progress of the calf.

When the period has arrived for allowing the calf to get accustomed to solid food, I should commence by giving it some finely cut pieces of turnips, mangolds, carrots, &c., which, from their soft and juicy nature, are preferable to any other drier food. This may be accompanied by small supplies of the best portions of the hay, which may be gradually increased as the calf gets older, but the supply of milk should be continued as before. A small allowance of meal may be advantageously spread over the cut roots. In weaning the calf it is desirable to bring the three meals into two, and after a short time, gradually decrease the new milk in quantity. This should not be done too rapidly, for a *sudden* substitution of skimmed milk for new milk generally produces a large-boned calf, with a coarseness of habit ill adapted for ultimately producing a good feeding bullock.

We have already noticed the composition of milk, and therefore we know what the calf receives, and also what is withheld. It is clear that the system cannot add to its growth any matter which it does not receive, whilst that alone which is presented to it in its food is capable of being used in promoting the growth of its body. In giving milk deprived of its butter, we supply saline matter, which forms the skeleton, and the cheesy matter from which the muscles are formed, but we have removed the oily portion which was destined to form the fat and fatty membranes of the body. Thus the growth of the skeleton and muscles is continued, but these muscles are not furnished with those fatty membranes in which the fat is stored, and which give to the skin of the animal that sure indication of a disposition to fatten which we know as "*the touch*." It only needs a careful observation of the calves thus reared to convince any unprejudiced mind that there is no economy in the saving thus effected. Substitutes are frequently employed, and undoubtedly lessen the bad effects; but when the primary object is to produce a superior class of stock, it will be desirable for the calves to have a liberal supply of new milk for at least two months. Linseed is very valuable as an assistant or substitute. Linseed gruel and Irish moss are also very good for this purpose. These substitutes, as more particularly stated (page 325), are very often employed, especially the mixture of linseed and bean-meal with molasses. The Irish moss is extensively used in some districts, and with successful results.*

* These substances are perhaps as good as any for making gruel for calves. Some, however, consider that giving substitutes for milk in this form encourages acidity in the stomach and scouring. Calves soon learn to eat fresh linseed cake in a dry state, and no other article is so easily digested, and so well fitted to promote health and growth.—ED.

The time of weaning must depend in some measure upon the season of the year when the calves are born. As far as possible they should be ready to wean in the month of May, and if they have been carefully managed for three or four months previously, they will be quite ready for weaning. The calves which may have been born in the preceding November or December will have made much more progress, and will also make more rapid growth during the ensuing season, for this advance, before going upon grass. The calf should be gradually accustomed to the use of green meat, and some early vetches, rye, clover, &c., will not only be an agreeable change with its regular supplies of food—cut roots and hay—but it will prepare the stomach for the more juicy food on which it is about to be put.

When the herbage has made good progress, and the weather become mild, the calves will be ready for going out. At first they should be put upon young seeds, and allowed to remain rather longer each day. It will be better for them to be sheltered at night for a month or six weeks, as the coldness may cause a very undesirable check. In fact, the calves would be better if they had the means of taking shelter through the first summer, for excessive heat and cold are alike to be avoided. An occasional change of herbage, with a free supply of water, will be the chief points to be attended to through the first summer. The calves should take the precedence of older stock, and the latter should finish the fields after the calves are taken away. If the supply of grass is abundant and good, this will be sufficient for them during the first summer.

If it should be wished to push forward the calf to an unusual degree, and it has up to this time been sucking the cow, both may be turned out into good grass, and the aid of the cow will be very evident in the growth of the calf. This, however, is only to be done in extraordinary cases; for, provided the calves have been brought forward well and prepared for turning out as directed, a good supply of grass will enable them to make sufficient progress for all general purposes.

Such, then, I conceive to be the proper management of the calf, from the period of its birth until, as a yearling, it is brought to the homestead for a further course of treatment. A system is thus adopted which leads to a constant and progressive development of all parts of the body, whilst the healthy discharge of the functions of life is carefully provided for. But it frequently happens that we have a neglectful system pursued, and the result is, that we have diseases peculiar to this age, which need special notice, not only because they urgently press upon us the importance of prevention—which is always better than the cure—but also to remind those who have taken a false course how to correct the ills which have arisen therefrom.

The earliest disease from which calves suffer most commonly is

Costiveness. Many of these cases arise from the prejudice on the minds of some persons against using the first milk which the cow produces. This is much denser and deeper coloured than ordinary milk, and is valuable as a purgative to the newly-born calf, being the safest and most effectual agent which can be employed. Many, from a mistaken prejudice, have this milk drawn from the cow and thrown away. The consequence is, the calf loses this natural medicine, a costiveness ensues, which is very often obstinate in its nature and difficult to overcome. At other times it is caused by dry food, such as hay, passing into the stomach of the young animal before it is ready to receive it. In these cases I should give 2 or 3 ounces of castor-oil, or else 2 or 3 ounces of Epsom salts, and ½ drachm of powder ginger.

Navel-ill is referable, in the majority of cases, to oversight and neglect at the time of birth. Bleeding is often suffered to continue, and drain the calf's strength, whilst a careful ligature of twine would have prevented the loss.

Inflammation of the Stomach is also another result of careless management, generally arising from the calf being allowed to *drink its milk greedily* and rapidly, instead of sucking it gently. The result is, that the milk is swallowed more rapidly than the stomach can receive it, and hence is forced into the rumen. Here it becomes sour and curdles; the cheesy matter remains, irritating the coat of the stomach, and finally producing inflammation. This is the cause of death in a large number of calves, and little can be done except by prevention. A dose of Epsom salts may relieve the inflammation, especially if given when the appetite first falls off. It is generally accompanied with grating of the teeth.

Scouring may be produced by several means: a sudden change of keep, and the use of indigestible food, are the more frequent causes. The former should always be carefully guarded against, but the cause will generally suggest the remedy. If they are removed to food of more solid character, it will probably cease, but care must be taken not to allow the bowels to become too costive. Should the change of food not prove effectual, some of the cordial named below will be found useful.

When the diarrhœa arises from indigestible food remaining in the stomach and causing an irritation of the membranes, it is evident that some medicine must be given to remove the offending matter, such as castor-oil or the Epsom salts and ginger already named; this may be followed by the use of a cordial or astringent mixture, consisting of—catechu, 1 ounce; spirits of wine, 1 ounce; laudanum, 1 ounce; water, 1 pint—in doses from 1 to 2 ounces twice daily.

The Management of the Yearling Heifers may now be noticed. These will be brought from the fields in which they have been summered, and placed in sheltered situations near the homestead.

An open yard, with sufficient shedding, is by far the best place for wintering young growing stock, and especially in preparing them for avoiding the quarter-evil, to which heifers of this age are peculiarly liable. Exercise is of the greatest importance to young and growing stock, as it enables them to bring the various parts of the body into action, and thus induces a healthy development of the organism. In addition to which, if young cattle have good shelter, and can at all times rest in a dry and comfortable position, they become more hardy in their constitution, and better able to withstand the attacks of disease, than that enervated and enfeebled class of stock which are confined in warm and ill-ventilated buildings during the winter months. I have experienced the difference in a marked degree, and I am fully persuaded that the want of exercise, and the too careful housing which young stock sometimes receive, are frequently productive of much injury to the constitution. On the other hand, when stock are neglected, and have little or no shelter from the storms of winter, they must necessarily suffer therefrom. The medium course is the best. Give the young cattle warm and comfortable shedding, with plenty of exercise, fresh air, and a liberal supply of bedding, and no fear need be entertained but that they will thrive better, and remain more healthy throughout the winter and *following summer*, than when kept in any other manner, especially under a system which shields them from every change of temperature, like conservatory plants. It is needless for me to draw the attention of my readers to the difference in their coats in the spring. If they are thus treated they retain their rough coats, as nature intended they should, until the weather renders it desirable for them to be cast away; but when young stock come from the houses in the spring, they generally have the sleek coat of summer to withstand weather for which it is not sufficient, and the result is a check, which is in most cases accompanied with an inflammatory tendency.

It may be argued that an economy of food requires a different system of management. I readily yield the point that stock which are thus exposed require more food than others will consume in more sheltered situations, and hence there is a sacrifice made in this respect. But I believe it to be a sacrifice which is well worth making, because you obtain thereby a degree of hardiness for the animal which is extremely valuable, and in comparison with which the extra food consumed is not worthy of consideration.

The usual food for yearlings during the first winter is hay and turnips. This is a very suitable food, but the addition of 1 or 2 lb. of oil-cake daily, according to the size of the breed, will favour their growth and condition, and much more than repay the expense (say 1d. to 2d. per day) in the animal, whilst the manure in the yard will be of superior quality. Hitherto the use of oil-cake has been too much confined to the *fattening* stock of the farm, but

I believe its use upon *the store stock* is frequently attended with *more profit* than upon the fat stock. It is, however, worthy of a passing remark, that store stock thus accustomed to small quantities of oil-cake subsequently fatten more easily than others not thus prepared for fattening. It will generally be found desirable to fasten up store stock whilst having their cake; a more regular consumption will then take place, and the stronger animals will be restrained from taking the share of a weaker neighbour.

Another point in the management of growing stock, and which is of great importance, is quiet and gentle treatment—everything like harshness being studiously avoided. They should rather be accustomed to receive attention, and allow persons to approach them without fear. In some yards it is almost impossible to approach them without the danger of their injuring themselves in their attempts to escape; whilst in other cases, when accustomed to quiet treatment, strangers even may approach and examine them.

By continuing such a careful and liberal course of treatment throughout the winter, we shall find the yearlings in good condition, and ready for being turned out to grass as soon as the season and the herbage are sufficiently advanced. During the second summer shelter and good keep will be equally beneficial, although not equally imperative, still nothing like a check should ever be allowed. The use of oil-cake may be advantageously continued to a small extent—say 1 lb. daily; but when the pasture is deficient, it may be increased. This will improve the land, whilst the stock will grow better and be much more healthy. In fact, it has been found that the use of small quantities of oil-cake has prevented the quarter-evil—a disease much dreaded by most stock-breeders.*

This *quarter-evil* is a subtle complaint, which is almost peculiar to our yearlings. It carries off large numbers of stock, and when its attack is commenced there is little hope of recovery. One general cause may be observed in the majority of cases, and it is the result of bad management. From some cause or other the yearlings have had *a check* in their growth. It may be from being wintered badly, or possibly from being put upon inferior pasture in the early summer, or it may be from sudden change from warm buildings during the cold nights of May, followed by a sudden

* Mr Wilson, Edington Mains, considers the use of linseed-cake as a specific in quarter-evil. His invaluable Prize Report on the Rearing of Cattle, published in the Transactions, may be consulted on this point. I have never met with a case of this disease in all my experience. Good keeping, however, may be considered not as a preventive in every instance,—a famous breeder of improved short-horns having lost in one summer four calves, which had been treated in the most liberal manner. The same breeder had lost from time to time so many fine animals by the disease, that he had to give up, from prudential motives, the breeding of valuable stock. This instance is rather against the idea that oil-cake is an unfailing remedy against the malady. Other agents, such as atmospheric influences or nature of the soil, have in all probability not a little to do with it.—J. D., Athelstaneford.

removal to better keep or more shelter. The first result of this change is a gradual improvement in the animal, which continues in a marked degree until the system is preparing more blood from this rich food than it has energy to use, and the result is an inflammatory action in one quarter of the body. Had the system been kept in a state of progressive improvement, it would have been prepared for the healthy employment of the nourishment brought into the system, but as this nourishment follows a period of scarcity, the system receives this rapid increase of rich blood more quickly than it regains its energy to use it, and hence an inflammatory action commences.

There are various modes adopted to prevent this attack. A seton in the dewlap is frequently employed with success. Occasional doses of purgative medicine have been found useful. The cause, however, appears to suggest the preventive by avoiding periods of insufficient food being followed by strong keep. It will sometimes happen that the keep is not sufficiently abundant for the stock, but this should be met by the use of artificial food (such as oil-cake, for instance), and great caution should be shown in putting stock upon better keep after they have had a short supply.

If, however, the quarter-evil makes its appearance, I have been frequently successful in curing the animal by giving one of the following powders three times daily—digitalis, 1 scruple; nitre, 1 drachm; tartar. antimony, 1 scruple. Its utility depends upon its *immediate* use, for the loss of half an hour may determine against its being of any service. The appearance of this disease should lead to extra diligence in preventing any others from suffering in the same manner, as generally there are others similarly predisposed for its attack.

Rheumatism is often productive of much inconvenience, and especially amongst cattle of this age. It generally arises from a want of sufficient shelter, or from stock being kept in low, damp land late in the season. Remedies are here of little service, for the attack soon passes off after they are removed from the cause.*

Management of Two-year-old Heifers.—Little need be added to the foregoing to describe the course of management which should be adopted the following season, for it is simply a repetition of the former year's practice. I shall therefore proceed at once to consider the time at which heifers should be allowed to

* The effect of rheumatism is understated; it frequently assumes an aggravated form, when once the ligatures and membranes of the joints get inflamed. A chronic tenderness or inflammation sets in—for such cases there is no cure. Young bulls are most subject to it. It is supposed by many to be the effects of cold, chills, or want of sufficient exercise while the animals are allowed nutritious food.—J. D.

breed. The practice of breeders differs as widely as it is possible, and many adopt a course they do not entirely approve of, to overcome greater difficulties which present themselves in making many of our best animals breed. These difficulties are oftentimes almost insurmountable, and many of our best animals are consequently placed in the hands of the butcher, with a very reluctant will on the part of the breeder. It is very desirable we should understand the causes which come into operation, as they are productive of much inconvenience and delay, and frequently lead to the loss of our best animals.

The fact is, what we consider a *perfect* animal is altogether an unnatural development. The consequence is, that as we diverge from the original type, so increased difficulties are thrown in our way for reproducing animals possessing such unnatural characters. If we take an ordinary cow or heifer, reared on common land or moors—it may be, under many hardships and privations—we find no difficulty in breeding from such an animal; but when we have—as we call them—better bred animals to deal with, we find a progressive series of difficulties. Are we then to consider the design of nature incomplete in this respect? Certainly not. This is no solitary instance of the opportunities of improving natural produce which stimulate the energy and industry of man, and of the reward which follows his perseverance. Look at the general produce of a farm, and observe the extent to which many of our most valuable productions differ from and surpass the original specimens from which they may have been obtained. All, however, if neglected, possess a tendency, as it is termed, *to degenerate*, or, in other words, to resume their original character; and this is doubtless a valuable property. Our improved cattle do not possess those conditions which are best adapted for perpetuating the species; and it becomes evident, upon examination, that nature, whilst she has with jealous care made abundant provision for perpetuating every description of animal and plant, and given them habits and developments best adapted to this end, has at the same time given them expansive capabilities. Thus, under the care of man, they are capable of improvement; but as soon as he neglects them, they gradually reassume their original form, in which they are independent of his care. So far, then, from being an imperfection in the design of nature, we see here how she encourages those who strive for improvement, whilst at the same time she has not overlooked the safety of the species when neglected and uncared for by man.

The difficulties which impede our breeding from highly developed animals are twofold—barrenness, and incapacity to retain the embryo. These are too often looked upon as similar, but there is a great difference between these two causes. Barrenness results from an imperfect development or action of the organs of genera-

tion; but in order that this may be fully understood, it will be important to have a clear view of the process of productive generation. The seed is formed in the ovaries of the female; as soon as an ovum is fully ripened, it causes a very great degree of excitement, and the animal manifests its desire for the male. This period is determined by the ovum becoming fully matured. Around the mouth of the ovarium we find the fimbriæ, which hold in their convoluted folds the ovum thrown off by the female, until the same is impregnated by the seminal fluid of the male. The impregnated ovum then descends through one of the Fallopian tubes into the uterus, and the development of the embryo into a fœtus immediately commences.

It is evident that many circumstances may render the animal incapable of breeding; for instance, malformation of any of the parts, and also want of energy in the system to enable the ova to be formed. Natural barrenness of this kind is beyond our control, and the animal will have to be fed; but generally speaking, the animal comes into heat periodically, and hence some other cause is indicated, for it seldom if ever happens that an animal which is incapable of breeding from the two former causes manifests this desire for the male. When, however, this is never observed, it is an old fashioned plan to give her a quart of milk from a cow which is bulling, and it is said to produce an excitement of the energy which had previously remained dormant.

The majority of cases of difficult breeding may be traced to the excitement of the uterus throwing off the impregnated ovum instead of allowing it to remain and become fully developed into a fœtus. The consequence is, that many animals continue to take the bull month after month without being productive, and various methods have been adopted to overcome this difficulty. Some bleed the animal immediately upon her taking the bull, so as to draw away blood from the part, and decrease the excitement; others throw water over the hinder part of the animal, with a view of driving the blood to the anterior portion of the body; another method is to throw some water into one of the ears of the animal; this gives a shock to the system, and the fright draws off the attention, and consequently lessens the excitement in the uterus. I have found the most successful plan is to allow the bull to serve again when the period of heat is passing off. It is, however, generally necessary to use a young bull for this purpose.

Many breeders of high-bred stock, to overcome this evil, have their heifers put to the bull very much earlier than they otherwise would do—in some cases when little more than yearlings. It is very evident that a great sacrifice is made by adopting this plan. Before an animal has made its growth and its parts have become fully developed, the energy of the system is diverted towards another object; if, therefore, the nourishment the heifer receives is

divided between promoting its own growth and that of the calf, it is evident that both will suffer therefrom. The parent is thus thrown out of proper form by the weight it has to support, and the entire system suffers from an excessive demand on its strength. The offspring is equally prejudiced, for it receives the constitution of an enfeebled parent, and for a considerable time shows the ill effects upon its system.*

It has been considered that this difficulty of breeding is a necessary consequence, but I have to a great extent overcome it by adopting the following plan. Presume that we are dealing with a choice lot of heifers, which have had every means and opportunity for becoming fully developed, and that from the period of birth until they are, say, from twenty-one months to two years old, they have been reared with the view of producing as perfect animals as the breed will allow. Supposing them to have been calved early in the year, they would, when brought into the yards, be twenty-one months or thereabouts: instead of putting them upon good food, they should be put upon a straw diet for a month or six weeks, not simply that they may pick over the choicest portions, but eat the greater part supplied to them. The result is, that this diet leads to a loss of condition, and a greater aptitude for breeding immediately results; for it is a law of nature, that any check upon the animal which threatens to endanger its permanency (disease excepted) diverts the energy of the body to a reproduction of its species.

I have seen the end gained by sending stock to another district, giving them change of climate and herbage, but it must be to inferior rather than superior keep. Heifers which have been removed from rich land in consequence of the unsuccessful endeavour to make them produce stock, and put upon the moors, have been found to breed directly. Of course, judgment must be used in the degree to which such a check should be carried, for a remedy which in itself is valuable may be rendered destructive by injudicious use.

My own experience and observation lead me to the conclusion that, through the early stages of life, a liberal system of feeding is most desirable, and that it should be continued until the animal has become well developed and ready for breeding. Then give a sudden change from good keep to a straw diet, and after four or six weeks commence using the bull. I would strongly urge that the bull should not be used until the heifers are thus prepared; for when once an animal has returned to the bull, it has a *greater* tendency to do afterwards. I therefore strongly recommend

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* Heifers may, at sixteen months, if properly developed, be put to breed without any injurious consequences, provided always that they are liberally fed during the period of gestation, and not allowed to suckle their offspring. By being put on good pasture they will grow freely, and this practice almost insures them going on breeding, and their shape is not injured.—J. D.

breeders not to use the bull first, and, having found it fail, then to adopt the above system. They should be carefully separated from other stock for some hours after they take the bull each time, and subsequently kept apart until all signs of heat have passed away. Should any cases arise in which the heifers fail to prove in calf by this method, and the breed is of such value as to render the additional expense but of little importance, send them away to the nearest common or moor for the following season, and let them be regularly brought to a good bull. I need scarcely say that any which prove to be in calf should *gradually* receive better food.

The difficulties with which breeders have to contend are not confined to the female side; it is therefore important to glance at the other part of the question. In rearing a bull the principles I have named apply with equal force, but I am bound to say are not equally disregarded. In fact, the generally-received impression is, that the young bull should have every opportunity for arriving at a perfect growth. I shall not therefore occupy valuable space by a recapitulation, but rather state that the same liberal system of feeding is of even greater importance in the case of the bull than I have represented to be for the heifers. Many allow young bulls to commence serving cows when twelve months old, but it is not to be recommended. I should rather advise delay until twenty or twenty-four months old. Up to this time every inducement should be given to the system to attain a perfect development by a careful course of management. Afterwards, however, whilst used as a breeding animal, it is desirable to keep the bull *in good condition*, but not as *fat* as is usually done. It is true that "fat hides faults," but the breeder need not thus blind himself, and add to any existing deficiency in the animal a want of vigour and energy which it is so important the bull should possess.

We may safely take it as a rule that, after a bull has attained a full development, our object should be to keep him in *active working condition*, rather than as a *fat* bullock. It is altogether a false idea that a tendency to this *excessive* fatness is given to the stock. My own conviction is, that the same bull, in good working condition, would throw a more healthy calf than he would when excessively fat, and with at least an equal disposition for fatting. In addition to this we must not overlook the large number of failures and disappointments which arise from *fat* bulls. There is less activity and less power without any compensating advantage; and therefore I suggest that the bull should be allowed to become well developed before being used, and subsequently, whilst being fed liberally, the food ought rather to have a tendency to form muscle than fat.

We may now refer to some other causes which render bulls unproductive of stock. There may be a natural incapacity to produce stock from malformation; but this, although existing in some in-

stances, is not frequent. Sometimes, however, an animal having produced calves loses the power of reproduction either for a time or permanently; this is generally the result of disease. It may arise from over-exertion, or premature use, but more frequently from inflammatory action, induced by contact with cows which have been driven far, or which have been running about violently. Many choice bulls are thus injured from cows being sent considerable distances. Cows which have been driven from a distance should always remain in some loose-box as long as may be prudent, so as to cool down before being put to the bull. If, however, the bull has caught this disease, he should be kept from breeding for a time, and the parts regularly fomented, and cooling medicine given. Mischief generally happens from the early symptoms being neglected, and thus the bull often becomes worthless.

Close relationship of blood is another cause of unproductive bulls; and they are often condemned, as incapable for producing calves, when an entire change of blood disproves their incapacity. This is even more evident with heifers.

In conjunction with this part of my subject, it may be desirable to make a few passing comments upon the chief points of character which should be possessed by breeding animals. I do so irrespective of breed; for although each distinct breed may have its own peculiarities, yet there are certain qualities which should be possessed by all breeds in common with each other. The first point to be clearly settled is the class of animal to be produced. It is not enough to decide upon breeding from a cow or heifer; we must rather decide what we want to produce, and select our animals accordingly. It may be either breeding, dairy, or beef-producing stock, which is required, but each renders a modified course desirable, and I may say necessary.

Breeding Stock.—As a general rule, it may be taken that, to produce superior breeding stock, no middle course is safe or successful. The *best* stock obtainable should be bred from, and it is bad policy to spare any moderate outlay in securing first-class animals. Many obtain *second*-class animals, and endeavour to raise from them superior breeding stock. I am convinced it is a wrong policy to adopt. Breeders will not generally spare their best animals, and it frequently happens that the best cannot be obtained. In such cases there is no choice but to select the best that may be obtainable.

In such cases *pedigree* is fully entitled to our consideration, and it is desirable that it should be watched with care. In all cases where the breed has been carefully preserved pure, great benefit will result from doing so. The character of a breed becomes more and more concentrated and confirmed in a pedigree animal, and this character is rendered more fully hereditary in proportion to the number of generations through which it has been transmitted.

By the aid of pedigree, purity of blood may be insured, and a systematic plan adopted by which we can perpetuate distinct families, and thereby obtain a change of blood without its being a cross. It is evident that any one adopting a systematic arrangement will be able to do this more effectually than another without this aid. This is the more important when the number of families is small, as is the case with Devons and Herefords, especially the former. The individual animals from which the Devons are descended are very limited in number and in a few hands, but, with some honourable exceptions, little attention is given to this point. The importance is rendered evident by the decreasing size of the breed, the number of barren heifers, and the increased delicacy of constitution shown in the stock of many breeders of that district who are not particular in this respect. The contrast between such herds, and those in which more care and judgment are exercised, renders the advantages of attention to pedigree very evident; for here the strength of constitution is retained, together with many of the advantages of this valuable breed.

Having then, with due consideration, selected the breed and the families of that breed possessing the points which are to be perpetuated, it is necessary to take individuals therefrom. The cows should be characterised by an aptitude for producing fine calves and bringing them to a full degree of development. They should therefore be good milkers, for the value of the produce will be very much regulated by this character. We shall have occasion to see subsequently that this property is in no degree prejudicial to any other desirable point of character. This tendency to produce milk not only influences the supply of food to the young animal after its birth, when any deficiency may be remedied, but it regulates the growth of the calf before birth, when a substitute cannot be used. Thus many of our best-bred short-horn cows produce calves which are very imperfectly developed and exceedingly weak—so much so, that many persons accustomed to *inferior* stock would consider them scarcely worth rearing. This is mainly referable to the supply of nourishment given to the calf being so small, for the subsequent supply of milk clearly indicates how limited had been the support given to the fœtus.

This neglect of the milking disposition is a great evil at the present day, and our best breeds are suffering, and will continue to suffer, from it until more attention is given to this point in the awards at the National Exhibitions. Here it should be made a leading point of merit, and this would stimulate breeders to give more attention to it. It has been sadly overlooked, but it is in the power of the Highland Agricultural Society, and other kindred societies, to do much to bring our breeding cows into a more satisfactory state in this respect. Already, great complaints have been made of stock sent abroad, and particularly from America,

which acts prejudicially on ourselves; and when it is seen that the possession of milking properties may be advantageously encouraged even in our best breeds, it is evident that it is only necessary to draw attention repeatedly to this fact, and sooner or later it must be corrected.

Breeding cows should also possess *strong and healthy constitutions*, and there are certain developments of figure which indicate their existence. No one would consider a flat-ribbed animal with a narrow carcass and contracted chest to give promise of health; neither would the rising of the rump-bone be a good feature. These are sure signs of a predisposition to consumption and diarrhœa. The full round barrel and the deep wide chest, together with a level back and broad pins, are essential points of healthy constitutions.

We are well aware that many diseases are transmitted from the parent to the offspring, which must be jealously guarded against. Dysentery, consumption, scrofula, and rheumatic affections have been clearly proved to be perpetuated in this manner. It is therefore of the deepest importance to avoid anything of the kind in the parents selected for a herd of breeding cattle. The three former frequently result from relationship being too close, in other cases arising from different causes, but the effect is the same, so far as regards the extension of the evil. That boldness of figure which we prize as indicating a well-developed animal is also valuable as a sign of health and vigour. Thus, those points which as so pleasing to the grazier are equally valuable to the breeder.

The breeder of first-class stock cannot be too particular in his selection of bulls. He must always be prepared to detect the weak points of his stock, and remedy them by using a bull well developed in these respects. Notwithstanding the great importance of having good cows to breed from, the influence exerted by the bull renders his quality and character of even greater importance. Not only are his good or bad qualities spread through the large number of cows he serves, but there are certain hereditary qualities more fully transmitted from the bull than the cow. The bull, therefore, should be as perfect as can be obtained, and possess the greatest purity of descent.

The following points may be said to indicate a well-developed bull:—

The Head should be rather small in proportion to the animal, and well set on the neck, with a fine tapering muzzle, a broad forehead, bright full yet placid eyes, furnished with a graceful horn of fine quality, and ears small and fine.

The Neck should be thick but not too short, but having a graceful appearance by tapering steadily towards the head, and yet not getting thin behind the ears.

The Shoulder should be snugly in the carcass; it should be

covered with a well-developed muscle down to the knee, below which it should possess a fine and flat bony structure.

The Chest should be bold and prominent, wide and deep, furnished with a deep but not a coarse dewlap.

The Carcass should be barrel-shaped, having a top level and broad, especially across the hips, the ribs should be well rounded, the space between the last rib and the pin should not be too short, yet at the same time we must guard against too much length; there will, however, be little cause for objection if the rib is well rounded and the bone flat, for it will add weight to the animal in a good part. The flank should be full and pendant.

The Hind Legs should be full and fleshy down to the hock, with a well-developed buttock, showing great substance, but below the hock we require a fine and cleanly-formed bone.

The Tail should be finely formed, without much hair.

The Hide mellow to the touch, covered with a fine yet plentiful coat of hair.

Animals thus developed in all these points will be alike gratifying to the eye of the connoisseur and profitable to the grazier.

Bulls have a natural tendency to show points of failure which are not observable in bullocks; and, taking all breeds into consideration, this is most frequently noticed by a deficiency in the hind quarters of the animal. Whilst, however, we should endeavour to obtain a bull as perfectly formed as possible, it is especially desirable to secure a full, I might almost say an excessive, development of any part which may be deficient in the cows or heifers he has to be used with. If they are weak, either in the fore or hind quarter, or if deficient in size, this may be remedied by selecting a bull distinguished for possessing these properties in an unusual degree.

It is in this respect that the extensive breeders have such advantage over those keeping smaller herds. It is necessary for them to keep three or four bulls, and very often they have more. The consequence is, that a selection can be made in such cases according to the deficiency of the heifer or cow; whereas, where only one bull is kept, this cannot be done without involving the expense and trouble of sending to a distance, and often this is not available. It is a matter of doubt with some how far an increase of size obtained by using a large bull can be done with safety to the females producing the calves. No fear need be entertained on this ground. The female *alone* determines the size of the calf at birth, but subsequently a larger growth shows the increase of size derived from the sire.*

* A large male has a great deal of influence on the size of the calf, as well as of the young in other animals. Well-known instances occur in the dog and the sheep. The mothers are often lost if the disproportion between the male and female is too

The possession of a good form and desirable qualities is not all that is necessary to be noticed in selecting a bull for producing breeding stock. We have also to observe how far this character has been held by his parents. Cases are frequent in which *inferior* cows have been put to *first-class* bulls, and the produce has rivalled the sire for beauty and perfection; but such an animal, although possessing in an eminent degree the formation of body which is desired, is totally unfit for being used as a bull. Here we have the explanation of the fact that many bulls which are most pleasing to the eye are noted for throwing inferior stock.

The explanation is clearly this, that the maxim of "like producing like" is modified by another law—viz, that animals have varying powers of hereditary transmission, dependent upon the degree to which certain peculiarities of character may have been concentrated within them. As I have before said, every successive generation "*in the line*" will possess, in a greater degree, the power of transmitting certain peculiarities; and immediately such an animal is crossed with a cow which has no such power, in consequence of *an irregular line* of descent, the bull exerts the greatest influence, and the progeny fully partakes of his character.

The quality of the produce is improved even more where this difference exists, than if a superior cow had been used. Lord Spencer noticed this many years ago. He says,* "It is admitted by every one that the qualities of the offspring are usually similar to those of the parents, either combining, in various proportions, the qualities of both parents, or taking entirely after one. I should say, as regards cattle and sheep, that in most cases the qualities of the male parent predominate in the offspring. I have also observed that the worse bred the female is, the more will this be the case when she is put to a well-bred male." This principle had been previously advocated by Rev. H. Berry in his celebrated Prize Essay on Breeding. It is therefore as important to see the parents of the bull as the animal itself; and no one pretending to any degree of careful breeding should neglect this point. Here we again observe the value of pedigree, which is so justly appreciated by short-horn breeders, who well know that any taint in the descent often reappears after several generations, to the prejudice of the stock.

An error is frequently committed by breeders of stock of *medium merit*, from not being particular as to the bull first used for their heifers, considering that as an heifer's calf is not generally desirable for stock, so it is not important to select a good bull. There is, however, little doubt but that the character of the bull *first* used gives an impress to the entire produce of that animal, even although

great. When small heifers are served with too large a bull, it is always attended with difficulty and danger.—J. D.

* *Journal of the R. A. S.*, vol. i., p. 24.

later calves are got by other bulls. The *temper* of the bull should not be overlooked, for it is established beyond all doubt that this is hereditary in the stock, and it influences considerable difference on the tractability, as well as the disposition for fattening, of all the descendants.

Breeding for Dairy Stock.—This requires a modified course of management. It happens, very unfortunately, that our best milkers are not generally our best fattening animals. It does happen sometimes that both points of excellence are combined in the same individual; but these are, generally speaking, cross-bred animals: for instance, the half-bred Guernsey or Alderney heifers are often remarkable for this, especially when crossed with a good Devon or short-horn bull. It would seem as if in such cases the dam gave the milking disposition, and when this is stopped, the aptitude of the sire for fattening made itself manifest. This is just what our knowledge of the principles of hereditary transmission would lead one to expect. In the heifer the tendency to give milk is strong, and has been a characteristic feature for many generations; it has therefore become powerful; whereas the influence conveyed by the bull is exceedingly weak, for his predecessors have been distinguished by little disposition for milk: hence, the power of communicating milking tendency being stronger on the side of the dam than the bull, she imparts her character to the offspring. The opposite is the case with the tendency to produce fat: here the bull is strong and the cow weak, consequently he is able to impart to the offspring an aptitude for producing fat similar to that which he possesses himself.

There is no necessity why these valuable tendencies should not be combined in the same animal much more frequently than at present; and I deem it so important a point, that I shall draw attention to the principles involved in the production of milk. From the analysis already given (page 326), the reader will see that milk contains the nutritious and heat-giving elements of the animal's food. It is interesting to observe the changes which the food undergoes in its transition to the body of the young animal, for the *same* elements pass through a series of transformations. We find them

In Food, as	In Blood, as	In Milk, as	In the Body, as
Gluten,	Fibrine & Albumen,	Cheese,	Muscle,
Sugar and Oil,	Fatty Matter,	Cream,	Fat,
Mineral Matter.	Mineral Matter	Saline Matter.	Bone.

The blood is derived from the food, and then transformed, either directly into the body of the animal, or indirectly through the intermediate stage of milk. Thus the same materials are needed in either case.

It might be presumed that as we know the elements required for milk, it is only to increase the food of the cow in either particu-

lar, and the effect will be evident in the production of milk. This, however, is not strictly true; for, although we may carry into the system an increased quantity of those matters which yield cheese or butter, yet it still depends upon the animal economy either to mould these elements into the cheese and butter we wish, or else into flesh and fat. This is quite dependent upon the natural disposition of the animal, and this is the keystone on which all depends. Thus, although *the same food* will in one case produce flesh and fat, whilst in another it will yield butter and cheese; still, when the tendency of the animal's system is thus marked, we can increase the product by presenting in the food an additional quantity of the elements required. It is clear, therefore, that the first point to be secured is this tendency in the system to co-operate with us. In this respect cows differ; but it is worthy of remark that these peculiarities are hereditary. If, therefore, we have a well-bred cow, with a tendency to produce an abundance of good milk, such a cow would, in all probability, impart to her produce a similarity of character.

The points which especially indicate good milking character must be noticed. The most prominent of these are the vessels which cooperate in the production of milk. These consist of the vessels which bring the blood, the glands which separate the milk, and the veins which carry away the blood when thus acted on. Of the former, I may name those veins which show themselves between the bearing (*vulva*) and the udder. These are often buried so that they cannot be seen; and although on pressure immediately above the udder they frequently appear, yet we must not immediately condemn the animal as a bad milker when they cannot be observed. Generally, if the skin is mellow, and not much fat present, these veins show themselves readily. Their presence is very desirable, and when combined with a full development upon the surface of the udder, they indicate a free supply of blood to the milk glands. It is also considered a good point when these veins present a knotty appearance.

The milk glands are situated in the upper portion of the udder, and are generally four in number, each gland being in connection with its own quarter of the udder. The udder should be capacious, extending well behind the legs, and also forwards under the belly; the coat should be thin, with a soft skin, and show considerable decrease in size after the animal is milked. The teats, which are the channels from the four reservoirs in the udder, should be placed well apart from each other, and not cramped together, for this generally indicates a want of capacity in the udder. The udder may appear large, and yet be found fleshy rather than capacious. After the blood has been acted on by the glands, it is conveyed away by the veins; but none of these can be seen externally. The milk vein, which runs along the side of the belly, has been so

called from its supposed connection with the udder; but such is not the case. Especial attention is desirable to the mellowness of the skin, and more particularly if the animal is poor. This vein is a sure indication of the quantity of blood supplied, and for all practical purposes may be taken as a guide.

Some attention has also been given within a few years to a discovery made by Mons. Guenon respecting "*the escutcheon*," as it is termed. Like many other persons, he was carried beyond the boundary of discretion in his speculations, and thus his valuable observations were for a time lost in the mist with which he enveloped them. Sufficient is already known of its value, at least, to lead us to the conclusion that it is worthy of more general knowledge. It can scarcely have escaped the reader's notice that the hair on the buttocks of cattle grows in two different directions—one portion pointing upwards and another part downwards, and thus producing a sort of fringe at the point of juncture. This hair, which has an upward tendency, has been termed "the escutcheon." A very extended observation has proved that, *other conditions being equal*, the modification of form presented by the escutcheon will lead to an estimation, not of *the quantity* of milk which the animal will produce, but also of *the time* during which the cow *will keep up the supply* of milk. Without going much into detail upon this point I may briefly state,* that the larger the extent of the escutcheon the greater is the promise of milk, and also of its continuance, even after the cow is again in calf. A cow may have a small escutcheon and yet be a good milker; but observation leads to the conclusion, that if she possessed a more fully developed escutcheon she would have been a better milker. It may be considered a point of merit, not as *deciding* whether or not the cow is a good milker, but rather as an additional indication, which may be taken into consideration in conjunction with other characteristic points. It is also desirable, in estimating the extent of the escutcheon, to make full allowance for the folds in the skin, otherwise a large escutcheon may be taken for a small one. Besides the escutcheon, there are tufts of hair (*epis*) which have a certain degree of value, when seen upon the udder of the cow.

With this safeguard, we might anticipate no difficulty in transmitting a disposition for producing milk, especially as we know these characteristic features are hereditary. But we must remember that there are hereditary influences conveyed from the bull as well as the cow, and hence an opposite character is often given to the produce by virtue of the bull's character. It may cause a degree of surprise to some that the bull should have any influence on the *milking* properties of his produce; but there is not the slightest

* Those who wish to examine this more deeply, may advantageously consult "*Traité des Vaches, Laitières*," par T. GUENON; or also, "How to Choose a Good Milk Cow," by J. H. MAYNE and JOHN HAXTON.

doubt of such being the case. A bull, the produce of a good dairy cow, would favour this character being shown in his offspring; and should he be bred with another good milker, *he would confirm this tendency* in the young calf; whereas, if he was descended from a family of bad milkers, *he would lessen the dam's influence* in this respect. It is here that Monsieur Guenon's discovery promises to be of great service, because we find the escutcheons seen upon the bull indicate a tendency to convey to his offspring the same peculiarities which they represent when seen upon the cow.

I have before casually remarked that our improvements in the breed of cattle have been accompanied with a decreased capability for breeding; and the same remark holds good as regards the milking tendency; and therefore it is a greater stimulus for the exercise of care, and such attention will be ultimately rewarded. There is nothing essentially contradictory in the endeavour to combine, in the same animal, milking as well as fattening properties. Many of our dairy cows are distinguished by *both* these conditions. In our high-bred animals we find a small liver and a small lung, accompanied with a gentle and peaceful disposition. Now, these conditions, which are so desirable for producing fat, are equally favourable for yielding butter and cream. These diminished organs economise the consumption of the carbonaceous matter in the blood, hence more remains ready for conversion into fat, but equally prepared for yielding cream if the tendency of the animal is favourable to the same. Having, therefore, by these means got the blood well charged with the materials from which milk and cream may be prepared, it only remains for the animal to secrete the milk freely, and the most economical results are realised. It is true, we may store the blood with materials ready for yielding a rich milk, but if the milk glands are *inactive* or *defective*, then the stream of blood passes over them, and yields but little of the very secretion we want. In many of our high-bred cows, not only are the breeding powers weak, but the milk glands sympathise with the general torpidity of this part of the system; and hence, although the blood may be charged with milk-forming matter, yet in consequence of the *inactivity* of the milk-glands, these fail fully to separate it; and the result is, that materials which might have been separated as milk and cream, pass on unappropriated, and probably become formed into fat and muscle.

The Breeding of Beef-producing Stock.—Practically this will be carried out with the local breed of cows; and if these are selected with judgment, and judiciously crossed, useful stock may generally be raised. Well-selected dairy cows will generally, *for this purpose*, be found equal, if not superior, to cows of the highest breed, by giving more weight, a larger frame, and hardier constitution; and, being good milkers, will rear their calves better. It is also very important, for producing well-developed stock, to

breed from cattle capable of yielding to their calves the full nourishment required. In every case the bull should be of *very superior* character, and cannot be of too good quality. The objection which I have named as regards the cows does not apply here. On the side of the sire, we should endeavour to secure *the very best qualities,* whilst the dam should be adapted *for bringing them to perfection.* It is a serious error to select an inferior bull for such a purpose, and only a matter of surprise that any of our class—who are generally such shrewd calculators of profit—should ever be found to adopt a practice manifestly indiscreet.

The destination of such stock should be for beef, because it is in the *first* produce you secure the advantages of both parents, but you cannot with safety use them for breeding purposes, as the *second* cross is generally an animal of very inferior quality. In the first produce we secure the advantages without the disadvantages, but the second cross is very inferior.

Throughout the entire period of growth the course of feeding should be liberal and generous, calculated to promote a progressive development of the body from the time of birth until consigned to the care of the butcher.

THE MANAGEMENT OF CATTLE WHILST BREEDING.

Having succeeded in getting the heifers in calf, it becomes necessary to give them a more liberal course of feeding, but the change must be gradual. They have now not only to render their own bodies complete, but also to nourish and support another animal which is daily increasing its demands on the system. Supposing the heifers to be running loose in the yards or sheds, they will now receive a few roots with their straw, and generally some hay. They must be watched to prevent any unruly or vicious one of the lot annoying or injuring the others; and separation must be made accordingly. After they leave the yards, pasturage of *medium* fertility will be best for them, so as to allow them to live well and keep in good condition without being absolutely fat. In this manner the size of the calf at birth is very much held under control. If the heifers are fed highly, the nourishment of the blood renders the growth of the fœtus more rapid than is desirable, and the result will be a largely-grown calf, which is especially dangerous for heifers. It is the food which the heifer receives during this period which determines the calf's size, rather than the sire, as is often supposed. Whilst, therefore, we guard against this *dangerous* error, we must not keep the heifers short of food, or we shall have weakly calves produced. A moderate allowance of food will be far better than either extreme. An animal which is in high condition is far more liable to disease after calving. Prevention, however, being better than cure, it should be our object to follow the happy medium of giving

them keep of sufficient quality to support them in good condition, but not overdo it by making the heifers fat.

Injuries frequently happen during this stage from the animals driving each other; this will arise when one or two bad-tempered ones happen to be amongst them. Goring with the horn upon the flank is a frequent cause of injury to the calf, especially in causing the heifer to strain herself in her attempts to escape. Running over steep land, and jumping over gutters in meadows, when tormented by the fly, are all conducive to the same end; it may be the loss of the calf, or else a disarrangement of the calf, which produces at the time of birth a false presentation. The false presentations are often accompanied with difficulty to the operator, and danger both to the dam and offspring. Too much care and caution cannot be taken to avoid injuries such as these during this period, as much loss and suffering may be saved thereby.

Abortion may be looked upon as one of the greatest difficulties of this period.* Entire herds often lose their calves from this cause; and it often ranges through large districts. Its causes are varied, and claim our attention. During the time animals are breeding, the imagination and senses are peculiarly susceptible of external influences. Of all the senses, probably that of smell is most energetic; and thus we find effluvia, which at other times is disregarded, is now peculiarly offensive. In consequence of this, we frequently find that after heifers have been kept in situations rendered disagreeable to them by such a cause, the system becomes so excited as to produce an abortion of the calf. Some smells are much more exciting than others, and more prompt in their influence—such, for instance, as the smell arising from a newly-born calf or a fœtus. I have known a heifer throw her calf (and the fœtus not being found, for the tract of ground was large), and it so affected the remaining fifteen, that within three or four days all had suffered abortion. An accident which causes a single cow to throw her calf may thus be the occasion of spreading it amongst a large number of its companions, in every other respect free from such attack previously.

It is also more frequent in some seasons than others, and certain districts are also peculiarly liable to its appearance. In a moist climate—such as that of the west side of England, and especially the south-western portion—cases are much more common

* It is not so common as is usually imagined, for cows which have once slipped calf continuing to do so afterwards. It altogether depends upon how it is brought about. If it arise from contagion from cows which have slipped their calves, the risk is no doubt great; but it is by far the greatest risk if the cow is predisposed, or weak of constitution—when the generative organs are not only weak, but highly sensitive at the same time. On the other hand, when it arises from accident—such as jumping, being gored, surfeit or indigestion, a chill, or water after being heated—there is little fear of apprehending abortion, if ordinary precaution is exercised. —J. D.

than in the drier districts of the east of England. No doubt this is excited and produced by the fungi which are found on our grasses, which appear to possess a power somewhat similar to, but milder than, the ergot of rye. I had on one occasion no less than twenty dairy cows and fifteen heifers under my care, and of these no less than thirty had previously slipped their calves during that season. The course I adopted was to stop breeding for twelve months, and in the mean time dispose of all that had slipped calf. I also had the buildings whitewashed, and other disinfectants were used. During the twelve months the ground was kept as clear as possible of any but feeding bullocks. At the end of this period I was able to recommence breeding with safety and success; but when it become so general, no other course appeared to be of any avail. It is by prompt attention to the *first* appearance that we have the best chance of success.

If an animal has slipped her calf she should be kept as if suffering from a contagious disease. Let all *breeding* stock be kept away from the field or shed in which it may have happened for a few weeks. If this cannot be done, and the building must be used, let quicklime and some chloride of lime be used freely before the stock are allowed there. The animal will, of course, have been removed to a place by herself for further treatment. This will consist in washing the hinder parts with a weak solution of chloride of lime, and giving her ½ lb. or ¾ lb. of Epsom salts, and a ½ drachm of powdered ginger. She should be fattened and disposed of forthwith, as she is almost certain to slip her calf again. I believe this is a source of great trouble, which breeders often bring on themselves. A very choice heifer slips her calf from some accident, and she is retained to have one more trial, and, unfortunately, gives proof of the truth of the maxim, "one infected sheep will taint a flock." I know it is very uncongenial to our feelings to part with the favourites of our herds, but judgment must govern our feelings, if mischief is to be prevented. This is a disease in which *half* measures are perfectly useless; the course of procedure here requires resolution and vigorous execution of the same.

Earl Spencer has published* a number of most interesting observations with respect to the probability of cows holding in calf for certain periods of time, and also of their producing live calves. His Lordship was thus able to calculate the probable number of live calves he might expect within certain periods.

We may now assume that the heifer has been brought towards the period of her calving, which generally happens from about 280 to 285 days from the time of conception. Lord Spencer has also aided us with a very extended series of observations, showing the influence which the sex of the calf has upon the time the cow

* *Journal of the R. A. S.*, vol. ii.

goes in calf. Lord Spencer adds, that no live calf was born earlier than 220 days, nor later than 313; nor was he able to rear any calf born less than 242 days. He considers any calf born earlier than 260 days decidedly premature, and any date longer than 300 days must also be considered very irregular. From 280 to 285 days is the more general time, at which age the sex of the calf does not appear to vary much. Those calves which were born within the preceding five days were principally heifer calves, in the proportion of 3 to 2; whereas those which were delayed for the same time were principally bull calves, in the same proportion of 3 to 2; and as the delay increases the proportion of bull calves increases, except when we come to those *extreme* instances of delayed parturition, when the calves appear to be all female.*

When the period approaches for calving, the heifer should be prepared for it by keeping the bowels in healthy action and the blood cool. With this view each heifer should have 12 ounces of Epsom salts, ½ drachm ginger, and ¼ drachm of carraway seeds in the preceding week, and repeated if not found effectual in relieving the bowels.† With this preparation we may await the time of calving. The depression on either side of the rump-bone, together with the appearance of waxy matter on the teats, are symptoms of approaching calving. Having provided the heifer with a convenient loose-box, she should be left to herself. When the labour-pains have been on her for half an hour or an hour, the man usually attending her may quietly examine the progress, and continue to do so every half hour subsequently, avoiding as much as possible causing any disturbance to the animal. As soon as the calf is making progress towards delivery, let him carefully try if the calf is in a right position; that is, with its two fore-legs protruding, and the muzzle of the nose resting upon them.

Having satisfied himself that all is right, let him give the heifer plenty of time for making a passage for the calf. It should be remembered that the bones of the pelvis have to yield for the passage of the calf, and it is much safer to allow Nature time for effecting this herself, and in her own superior manner, rather than endeavour, by applying force to the calf, to make a passage by other aid. Much mischief arises by persons being in too much hurry about these matters. The great point is to be assured that the calf is in its right position, and then give the heifer every opportunity of aiding herself. When the fore-feet show themselves assistance may be given, but even then not with that violence which is so

* The age of bulls influences in a very considerable degree the sex of cattle. Old bulls get heifer calves in the proportion of 3 to 2, and young bulls *vice versa*.—J. D.

† Bran-mashes, with a very short allowance of fodder, is the best preparation before calving. If anything else is required, 1 to 1½ lb. of molasses diluted in water may be given once a-day. If a cow has had a bad time, then 1 lb. of Epsom salts, along with 1 lb. of molasses, and ¼ oz. of ground ginger.—J. D.

often used. Excessive strength is quite needless, and is productive of much injury. A firm and steady pull at the fore-legs simply to prevent any return of the calf when the pains cease, and also to aid the calf forward when the pains return, will be of great service to the heifer, whilst an over-eager application of strength, often almost enough to carry the heifer away, is worse than useless.

In cases of false presentation much suffering and loss will be saved by calling in a veterinary surgeon. I should prolong this report beyond its proper limits if I were to go into this branch of the subject.

As soon as the calf is born, see that it can perform that new function of life—breathing. Up to this time this has not taken place, but now it has lost the warmth of the mother's body, it requires another supply of heat, and this is produced by the process of respiration. Any film over the nostrils should be removed; and if the calf cannot draw breath, it should be done artificially by blowing down the throat, and the lungs, having once expanded, will probably continue to act. If the birth of the calf has been tedious, it may be much exhausted. In such cases, a little gin and peppermint may be given in some gruel, but if it can be avoided with safety to the calf, it is preferable to do so. The calf should now be drawn to the heifer's head, and she will amuse herself by cleaning it. Shortly after, some warm gruel should be given to the heifer, and followed by a bran-mash; but if she appears much exhausted, the gruel should be given quickly. In cases of protracted labour, thirst should never be allowed to continue, but occasional draughts of warm and thin gruel may be advantageously given.

Having traced the proper management of cattle from the period of birth until they have produced a successor capable of following a similar course, I shall proceed to notice—

THE MANAGEMENT OF COWS AFTER BREEDING.

After the delivery of the young calf, our management of the dam must be of a preventive rather than a curative character. The cow, having been refreshed by the bran-mash and gruel given, may be safely left for a time quiet and undisturbed. In the course of two or three hours she should be drenched with 12 ounces or a pound of Epsom salts, mixed with 1 drachm powdered ginger, and 1 drachm carraway seeds. If she has had *an unusually bad time,* it will be desirable to give it rather sooner, and combine with it one of the following fever powders, consisting of—nitre, 2 drachms; digitalis, ½ drachm; tartarised antimony, ½ drachm. These are calculated to check any tendency to fever in the system; for it must be remembered that the heifer has undergone a very severe strain upon the system, and the appearance of inflammatory action is therefore to be guarded against. The fever powder should only be added *after*

cases of difficulty, in which the animal may have suffered badly; for, in ordinary cases, the former drench will generally be found sufficient.

The after-birth (or *placenta*) will probably be thrown off within twenty-four hours, but it may remain several days. The appearance is the greatest annoyance, for it does not seem to inconvenience the animal. It is better to avoid the removal of it by hand, although this must be done if it appears to cause irritation and inflammation. A small weight is often tied to the after-birth, if it is not thrown off in proper time, and this gentle pressure tends to its removal. Many are in the habit of giving irritating and exciting cleansing drenches, which are productive of much harm. If anything is given, probably a pint of good ale in some gruel is as good as anything. The object should rather be to prevent all further excitement, and to quiet the system as much as possible.

The drop after calving is one of the earliest and most serious attacks to which the cow is subject. Here, however, is a case for the attentive care of a veterinary surgeon, and no time should be lost in securing the same.

Attention should also be given to the state of the udder and the flow of milk. In some cases the udder feels hard and lumpy. This requires gentle friction, with some softening ointment, such as elder-flower ointment. If this friction be repeated two or three times a-day, and the calf allowed to suck immediately after, it will probably become supple in a short time. Many persons allow the calf to run loose, and suck the cow at liberty, and in slight cases this generally answers. The udder must still be watched, and if not relieved by this plan, it should be rubbed by the hand as before directed. Warm fomentations are useful, but unless care is taken there is some danger of catching a cold afterwards, thus only increasing the original evil. These warm fomentations should always be followed by the use of some lard or elder ointment, which lessens the risk of inflammation. Any sudden loss of the milk, or any great decrease in its quantity, must be carefully attended to, for there is always risk to the animal. Cloths soaked in warm water must be applied to the udder, and one of the fever powders (p. 334) given to the cow, together with a dose of Epsom salts. The return of the milk will be the first sign of improvement, and this should be drawn off as fast as it comes into the udder. The drench recommended above may be generally given to cows when the milk lessens, because this almost always arises from inflammatory action in the system.

Soreness of the teats is often observed in cows, and if neglected has a tendency to injure the temper, for the painful handling is almost sure to make them kick; and if the cause is not remedied, they become bad-tempered and permanent kickers. Any soreness should have *immediate* attention, and the following ointment is

very purifying and healing. It should be applied to the teats after the cow has been milked, and the part washed before the next milking:—Melt together 6 ounces of lard, and 2 ounces of bees'-wax, and 3 ounces of olive-oil; and, as they cool, rub in 2 ounces of sugar-of-lead, and 2 drachms of alum. These substances should be *finely* powdered, and well mixed together before adding to the melted lard.

The early precautionary measures having been taken for the preservation of the cow's health, we may presume that she is progressing favourably, and rearing her calf. After a few weeks she will again come into season, and be ready for taking the bull. This time, however, we shall be comparatively free from those difficulties which attended us at this stage previously; for, having once produced a calf, the animal becomes more adapted for doing so again. Should any difficulty arise in this respect, we cannot adopt the usual remedies as freely as before; for now we must remember that we are dealing with an animal *producing milk*, upon which the calf is dependent. Besides this, any imprudent step which checks the milk is always felt by the animal when the same period returns, therefore the loss of the cow's milk would depreciate her subsequent value. But the greatest danger from the loss of milk is upon the animal herself; for if the milk-glands cease to act, the effect on the system is most dangerous. I should, in any case of difficulty, adopt the plan of using the bull twice, as before recommended, in preference to any other plan; and this will be found almost always to overcome the difficulty, especially if she is put to the bull when *first* she appears ready.

When the cow is far advanced in calf, it is necessary to stop milking her, in order that the entire nourishment of the system may be shared between the growth of the calf and in giving fresh vigour and strength to the dam. It is usual to give two months' rest, but with high-bred stock, which do not nourish their calves very well, three months is decidedly better. We thus divert the nourishment which would be drawn away as milk, and the result is a great improvement in the calf, the cow is prepared for the delivery of her calf, and the subsequent flow of milk is improved. In the later months the calf requires a very considerable amount of nourishment, and, when a well-developed animal is sought for, we should encourage its formation by drying up the milk.

It now remains for me to notice the mode of feeding, and system of management, to be adopted whilst producing milk. I shall presume that the calf is born in one of the early months of the year, and from this period the cow will be kept in a comfortable building until the grass is ready in the spring. Moderate exercise is desirable, if it can be given; still shelter is even more important; but their combined influence is best. Many have not the opportunity of giving exercise under shelter, and frequently cows are put out

into an adjoining field for an hour or two during the day; and instead of their taking exercise, they stand and call for their release from the cold. When thus turned out from warm and ill-ventilated cow-houses, as is too frequently the case, they suffer much more than when kept in healthy and moderately-sheltered boxes or stalls.

It should be remembered, that whilst too much warmth weakens the animal, and renders it more subject to disease, the opposite extreme of cold draws upon the food for supplying additional heat to the body, and consequently less remains to yield cream. It is therefore economical to shelter a milking animal from the cold; but at the same time we must not economise heat to the prejudice of the health and comfort of the animal. We may take it as a rule that, so far as we can promote the health and comfort of the animal, so far shall we succeed in rendering the cow more competent for the support and development of her calf.

The *food* of the cow during this period claims our notice; for we can exercise great control over the milk by regulating the food from which it is produced. Succulent food, such as mangold-wurzel, and brewers' grains, &c., always produces a large *quantity* of milk; but it is not quantity alone which is important to the calf. The *quality* is the chief point for this use; and here we find good hay and linseed-cake showing themselves in a very marked manner, and producing a much larger produce of cream. If, however, the requirements of the dairy render the production of cheese desirable, we have to look at the quantity of curd produced; and here we shall find the importance of exercise, and such food as clover, hay, or vetches. If, in such a case, artificial food is given, bean or pea meal would be the best for producing *quantity* of cheese, but the addition of linseed-cake to the food would very much improve the *quality* of the cheese. Here, as in many other instances, the object in view must determine our course of management, for the food must contain the materials we want,—whether it is water to give quantity, or rich oily matter to produce cream, or highly nutritive matter to yield cheese,—for they cannot substitute each other in their modes of operation or uses.

It is also worthy of comment that, whilst exercise has a tendency to increase the quantity of cheese, it deteriorates from its richness. Hence we find our richest cheeses are made from strong and fertile land, where the cows take only a moderate degree of exercise, whilst those hilly farms, which render more active search for food necessary, give proportionately more cheese, but it is of inferior quality. Exercise cannot fail to use up, by respiration, a certain quantity of carbonaceous matter, which would otherwise be appropriated to the milk; and it is simply a question of the supply of oily matter being decreased on poorer land, by being used for another function of the body which exercises a prior claim. This would lead one to anticipate that, for the production of cream, our stall-fed cows would

be superior to others, whilst, for a cheese dairy, a greater amount of exercise is desirable, and the practice of our dairy district strongly confirms such an inference.

I have thus endeavoured to bring before the reader the leading points connected with the breeding of cattle. I have traced the calf through its successive stages of growth until it has produced a successor capable of again performing the same circle. I have noticed the management most desirable for these several periods, and the principles upon which such practice is based, together with the diseases to which each age is peculiarly liable. There is no branch of rural economy of greater importance to the interests of agriculturists. It is a subject which demands our careful attention, and it will reward our zealous endeavours to make the functions of animal life subservient to our requirements.

ON PARALYSIS IN LAMBS AND SCAB IN SHEEP.*

By PROFESSOR DICK, Veterinary College, Edinburgh.

PARALYSIS IN LAMBS.

AT the Monthly Meeting of the Society on the 15th December 1858, I read a communication on the subject of Stomach or Grass Staggers in Horses, which had prevailed to a great extent during the previous summer and autumn, and I am induced to resume this subject in consequence, not only of the recurrence of the disease in horses, but from the occurrence of a similar disease in cattle and sheep, or more especially in lambs, in many parts both of England and Scotland. Early last summer, Professor Goodsir was consulted as to the cause of so great a number of lambs becoming affected with paralysis of the hinder extremities, and I also had communications on the same subject. Among others I had a letter from an old pupil of mine, Mr Waldie, residing, and in practice, at Jedburgh, in which he states,—

I take the liberty of writing you regarding a disease that is attacking a number of lambs on a farm in this district. The disease is a kind of paralysis, or rather a want of nervous energy. A weakness in the back comes on suddenly, and gradually increases; they tumble over when suddenly approached, and when they get away, drag their hind legs. They are generally in good condition when seized, but gradually pine away to poverty if allowed to go on. I may state that the disease has been prevalent on several farms in the district. In similar circumstances it happens after

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* This article formed the address at the Monthly Meeting of the Society, 11th April 1860.

the land has been limed, and goes off again when the lime begins to get exhausted. The land where it prevails is the sloping land from the vale of the Teviot, and it is dry. The soil is a mixture of sand and red clay, with a strong red clay subsoil. The farms where the disease has been prevalent have, with one exception, a freestone bottom.

A short time after the receipt of this letter, Professor Goodsir called on me, and as he had had one or two lambs sent him, with an offer of others, I requested him to obtain one or two for observation and experiment. Professor Goodsir accordingly got two sent me, one from East Lothian, and the other from Mr Monro, Fairnington, Kelso. The latter came on the 4th July, the other some days previously. The first was quite paralysed in the hind legs, the other was comparatively slightly affected. They were both put under treatment by first clearing out their bowels by a dose of common salt (which was occasionally repeated), and afterwards sulphate of iron, given in doses of one or two drachms daily, and one dose afterwards given night and morning. The first, which had been under treatment previous to the other arriving, appeared to be rapidly improving, but afterwards relapsed, although the medicine was continued, and completely lost the power of using its hind legs. The other, on arrival, was put under similar treatment; two ounces of common salt were given, dissolved in water, as a purgative; and when her bowels were cleared out, two drachms of sulphate of iron were given night and morning; and this animal gradually recovered. They were both fed on clover grass, and after it was consumed, on the best clover hay. They were both kept on till November, in order that my students might have the opportunity of seeing the symptoms and progress of the disease, as well as the *post-mortem* appearances, which were fully developed. The one belonging to Mr Monro was sent home about the 12th December, and the other was killed, and a careful *post-mortem* examination made by Dr Young, one of my assistant lecturers, his department being Physiology and Microscopic Anatomy. After conversing with Professor Goodsir on the subject, Dr Young wrote out the following statement:—

Notes on the Spinal Cord of three Lambs.

According to Professor Goodsir, the two spinal cords examined by him were in a softened condition. The softening appeared to be confined principally to the dorsal portion, and indicated itself by the slight collapse of the cut surface when a section was made through it. The cervical as well as the lumbar portion was found to possess the normal degree of hardness. On making a microscopic examination of the softened portion, the nerve cells as well as the nerve tubes presented their usual appearance, no trace of any structural alteration being observable; on the other hand there appeared to be an increase of the ill-defined granular matter, such as is always seen on sections of the cord. The granular matter alluded to floated in a quantity of fluid between the nervous elements, while the latter, as already mentioned, were unaltered. In the lamb which I examined, and in which the disease was allowed to run its course for a considerably longer period than those examined by Professor Goodsir, a different condition of the cord presented itself. Instead of being softened, it appeared to be unusually hard, and on making a microscopic exa-

mination, I found that, while the nervous elements, both cells and tubes, presented no visible structural alterations, a small quantity of a homogeneous tissue, which may be regarded as fibrous tissue, appeared to be situated between the nerve elements.

In the absence of more extended observations, the following conclusions may be drawn:—The disease under consideration evidently consists of a subacute inflammation of the cord, as shown by the effusion of fluid and deposition of granular amorphous matter between its structural elements. As the disease became more chronic, however, the fluid would appear to be absorbed, and its place supplied by homogeneous fibrous tissue. In other words, the functions of the spinal cord are destroyed, not by any structural alteration of the proper nerve elements, but by an inflammatory action of the connecting tissue.

Along with the lambs sent to Professor Goodsir, there was transmitted a small quantity of the grasses taken from the fields in which they were pasturing, among which were found several plants of a poisonous nature, such as some of the ranunculus and hellebore. My assistant, Mr Strangeways, informs me, that in a field in Wharfdale, in the neighbourhood of Otley, in Yorkshire, he observed eight or nine lambs affected with this peculiar paralysis, and he was therefore induced carefully to examine the field, and in doing so found a large quantity of the grass of the previous year full of ergot; in another field in which were two of these lambs affected, he also found grass in the same state. He intended to have followed out his observations this year, but has been prevented by being appointed to lecture here. The subject, however, is one worthy of further research.

Mr Brydon made some remarks on the subject when I read my last paper to the Society, and in a letter I had from him, he informs me that, in the district about Traquair, there are every season more or less cases of paralysis in lambs, but the greatest number in hot and dry seasons. He says,—

> I have examined numbers of them, and find the stomach to be the seat of the disease, but the brain and spinal-cord also affected. In the stomach of lambs on dissection I have always found a pultacious mass of wool, grass, clay, and milk,—badly nursed lambs are the most apt to become affected, as they are most liable to take wool into their stomachs. When there is little or no milk on the ewe, the lambs suck the wool and swallow it, and at the same time taking grass before they are able to ruminate properly. It is also produced by rye-grass when they are further advanced, as in the months of July and August; at that time good fat lambs often become affected by eating the tops of dry rye-grass, but there is then little loss, as they are quite fit for the butcher.

From the facts stated by Mr Brydon of the disease being most common in dry and hot summers, and from the observations of poisonous herbs discovered by Mr Strangeways, it appears most probable that the disease is produced by the ergot on the grass. Mr Finlay Dun has shown in his treatise that, as a poison, ergot affects the nervous system, producing, after a variable time, depression and paralysis, more especially of the hinder extremities; and the experiments of Dr Samuel Wright, to which also Mr Dun refers, corroborate that opinion. I think that, in all probability, the disease is the effect of the poisonous influence of the

ergot, and as it must act on the ewe as well as the lambs, it is very probable that in those cases where the lamb is affected either at or immediately after its birth, the affection must have been occasioned by the influence of the poison upon the mother, especially as the power of the poison is not very active or immediate.

From what has been stated it will appear that something may be done as a means of prevention, and for this purpose I think it would be desirable to have a plot of young grass prepared every year, to turn the ewes and lambs on for a part of every day, or to give them a small quantity of linseed cake, as a means of clearing out the bowels, and thereby preventing the bad effects of any poisonous vegetable that may grow in the field.

From the experiments I have made, as well as the investigations of others, I have come to the conclusion that the disease may be successfully treated, by giving, on the first appearance of it, a dose of common salt sufficient to purge the lamb, and to follow that with a tonic or stimulating treatment, the simplest of which would be the sulphate of iron, in doses of 1 or 2 drachms daily, or twice a-day, according to the severity of the case, with as much ginger and 2 oz. treacle; many other remedies might be suggested, such as vegetable tonics, or even electricity, &c., but I think that which I have mentioned is the simplest, cheapest, and best. In some parts of the country this disease is called the louping-ill by the shepherds, as the lambs make frequent convulsive efforts to rise; and I am of opinion that, while there is a close connection between these diseases, there is a marked distinction, inasmuch as in louping-ill there is evidently an affection of the brain as well as the paralysis of the limbs, while in the cases of simple paralysis the brain did not appear to be affected; at least such was the case in the examples I had the opportunity of seeing. I am, however, of opinion that in both nearly the same causes produce these diseases, namely, the kind or quality and condition of the food operating on the digestive organs, and through them on the brain or nervous system; and I am the more inclined to this opinion, from the result of a case of louping-ill which was sent to the college many years ago by Mr Steedman, Boghall, in which the animal completely recovered, and in the following season produced two lambs, after being put under the treatment which I have recommended.

This leads me to remark that too little attention is paid to the securing of proper food for sheep, and I have no doubt both louping-ill and sturdy are materially increased by coarse and innutritious grasses, and want of proper sheds for shelter, of which there is proof in the difference of the prevalence of these diseases in some localities on the opposite banks of the Tweed; on one side the grasses are coarse in many places, on the other side fine. Mr Brydon, V.S., Peebles, informs me of a case where a farmer near

Traquair, some years ago, had 20 per cent of sturdy, arising from keeping his hoggs on very bare pasture; but now, by keeping them on better pasture, and giving a portion of rape cake and a few turnips, for two years past sturdy has almost disappeared, even although the shepherds keep as many dogs as formerly. Mr Brydon remarks that he "can find nothing so important as the means of preventing louping-ill and sturdy, as ploughing up hill pasture where that can be done, so as to get a good bottom of clover. In many parts, too, by a little care and trouble in irrigation, good meadow hay might be secured, and, this given daily to hoggs, with ¼ lb. of rape or linseed cake, when grass is scarce, they would be kept in good health and condition"

It has been supposed by Kuchenmester and Siebold, two German physiologists, that if lambs are made to swallow tape-worm taken from the dog, they speedily become affected with sturdy; the ova of the tape-worm, getting into the circulation of the sheep, is deposited in the brain, and there becomes developed into the hydatid, causing sturdy. It would, however, require an immense quantity of the feculent discharge from two or three dogs, and that containing an immense quantity of tape-worm ova, to be distributed over a hill, to cause the sturdy to the extent of the number found affected. But I have been informed by Mr Williamson, huntsman, St Boswells, of a curious fact, which goes far to contradict the notion of sturdy being produced in the manner these physiologists suppose. He says that he has a field near St Boswells, in which he exercises his pack of hounds, both young and old, up till the hunting season begins, after which it is pastured by sheep, and he has never heard of a sheep being attacked with sturdy there. The field, being well manured by the dogs' dung, produces rich pasturage, and this does not appear to produce any injurious consequences.

The dryness of last summer, by producing a premature ripeness of the grasses, and over-ripeness rendering them astringent, appears to me, in combination with the ergot, to be the cause of the disease. As a means of preventing it, I would therefore suggest an allowance of linseed or rape cake, and to have a field of young clover in reserve to turn them on for a portion of the day, so that the digestive organs may be kept in a healthy state. The necessity of this is shown by the following account of what Mr Dow, one of my students, saw at Amulree last September. At that time a great many flocks passed that place towards the south, all of which had a greater or less number affected with louping-ill. In one flock, consisting of 1400, there were twenty-six deaths before they left Amulree. Mr Dow took fourteen under treatment, of which twelve recovered. The treatment consisted in giving 3 oz. Epsom salts, ½ oz ginger, and 4 oz. treacle; next morning, 2 oz. common salt with treacle; and by adopting this treatment, he was informed that

they scarcely lost any others on their journey. On dissecting those which died, he found the third stomach filled with dry and hard fibrous grasses unchanged, and the plies of the stomach inflamed.

SCAB IN SHEEP.

If I have not already exhausted your patience, I would wish to bring under your notice some communications I have received on another disease of sheep, viz., the scab, which shows the effects of ignorance and prejudice to a great extent both in England and also in Iceland. In October last, I received a letter and some other papers from Mr Lambert of Manchester, father of three of my pupils, giving me an account of a curious case which had taken place at Lincoln. "A lot of twenty-nine sheep were sent to the market, nine of them were bad ones, some of them scabbed, the other twenty very clean, and 48s. per head was refused for them. The policeman took the nine from the man having charge of them in the market. The person in charge immediately started for home with the twenty sound ones. When he had gone a distance on the road, the constable overtook him on the highway, and, seizing the twenty sheep for which £48 had been refused, they were all destroyed. The owner, Mr Copland, was fined £20, and could get no redress." He was summoned before three of the magistrates of Lincoln, and condemned under the Act for the prevention of the spread of the sheep-pox (variola ovina) in 1848, but which was not intended to apply to scabbed sheep. The only Act which has ever been passed respecting the scab in sheep is the 38th George III., cap. 65, which does not prevent, and was never intended to prevent, the sale of scabbed sheep, but merely attaches penalties to knowingly and wilfully stocking commons and other open and unenclosed places with scabbed sheep, and so spreading the disease. Mr Copland consulted Professor Symonds as to the non-identity of the scab and small-pox in sheep, and the following is his opinion in answer to the questions put to him:—

1. Do you happen to know whether it was intended by the legislature that the Act in question (11 & 12 Vict., cap. 107) should or should not extend to sheep affected with the scab?

Ans. The Act was not intended to apply to *any* disease save and except the small-pox in sheep. In the passing of the Act, the words, "or any disorder of the like nature," "oxen, bulls, cows, calves," "either of such disorders as aforesaid," &c. &c., were omitted to be struck through. Small-pox is a disease specially belonging to sheep, and not affecting other animals. Small-pox ceased entirely in England about three years after the passing of the Act, and it has had no existence in this country since that time.

2. Is the scab in sheep "a disorder of the like nature" with the disorder known or described as the sheep-pox, or the variola ovina, mentioned in the Act? and if not, in what respect and to what extent does it differ?

Ans. Scab in sheep is not of the like nature as the sheep-pox, nor does it bear any resemblance to that disease; it is a disease which depends upon the presence of acari or mites on the skin, is entirely local, and, although it produces loss of con-

dition in the animal affected, does not otherwise deteriorate the quality of the flesh; scab-sheep are, consequently, fit for food. Small-pox is a constitutional disease highly infectious, very destructive to life, and renders the flesh of the animal unfit for food.—(With reference to the symptoms, both constitutional and local, of the sheep-pox, see SYMONDS *On Variola Ovina.*)

3. Is not the scab frequently met with in sheep, and does it not admit of a perfect and ready cure?

Ans. Scab is a disease of frequent occurrence among sheep. Animals having been badly kept, and exposed to wet and changeable weather, particularly if long-woolled sheep, are thereby rendered more susceptible of the infection; its communication from one animal to another depends upon the acari travelling from sheep to sheep. It admits both of a perfect and ready cure; the longer the disease has existed, the more difficult it is to eradicate.

4. Are sheep slightly affected with scab considered unfit for food?—(See replies to second question.)

Professor Symonds further remarks as follows:—

Had small-pox existed in this country, and supposing the animals in question to have been affected therewith, then the order by the magistrates for their destruction being accompanied by a power to dispose of the skins, would have been an effectual means of extending the disease to other sheep—the virus of that disease being located in the skin. No two diseases affecting the same animal can differ more from each other than scab and small-pox, and never was it intended by the legislature that the Act should apply to any other disease save and except the small-pox, or diseases of the like nature, supposing they had existence; there are none, in fact.

The opinion of counsel was taken, and it proved to be so much in favour of the Act of 1848, including within its provisions scabbed sheep, that Mr Copland is left without a remedy for the injury done him. It is clear from what Mr Symonds says, that the legislature did not intend to include scab. It therefore appears to me that the Society ought to look into this Act and get it amended, otherwise it may happen that some other parties may have sheep seized and destroyed in far greater numbers on some future occasion; and as I agree with Mr Symonds that the flesh is not injured by scab farther than that the sheep are prevented from thriving owing to the irritation it produces, and as the disease can readily be cured, such wholesale destruction ought not to take place. If ignorance, prejudice, and fanaticism were allowed to proceed, as has been the case in Iceland, wholesale, we might soon have our hill-stocks thinned, and our supply of mutton materially abridged. I may here give you an account of what took place nearly two years ago in Iceland, from commuications I have had from R. M. Smith, Esq., regarding this disease, during 1857-8:—

A disease had existed among the sheep throughout that country for some years, caused very probably by pasturing too many on the scanty herbage, increased, no doubt, by the long winter of 1856-7, and the want thereby of sufficient food; but the wise men of Iceland thought otherwise, being of opinion that it was a disease imported into the island, not only incurable, but so contagious, that when any disease was found in a flock, the whole must of necessity become diseased.

At a meeting of the Althing, or Parliament, held every two years at Reykjavik, the capital, in June 1857, there being twenty-five representatives present, it was

moved by one of the members, and put to the assembly,—That wherever throughout the country the disease showed itself among the sheep, the whole flock should be shot down. After several days of hot debate, this extraordinary proposition was carried by a majority of 21 to 4. In vain the minority protested, and the governor, the inspector of physicians, and one or two others, desired that the usual appeal should be made to the King of Denmark, maintaining that the disease was curable. It was ruled that this was a matter for home legislation and immediate action, and therefore the order for extermination was given. The sub-governor of the North, fired with zeal for the cause, had already commenced the work of destruction. The sub-governor of the West, only a little less tardy, willingly lent his aid; and even in the south and east of the island, the people, by a mad infatuation, joined in the crusade, and a number, estimated by some at not less than 40,000, and by others even at 60,000, were destroyed. The result of numerous inquiries as to the number of actually diseased sheep among the number thus shot down, gives an estimate not exceeding 9,000 to 10,000.

The number of sheep in Iceland, calculated from the returns of a small tax levied on the proprietors, is 400,000, but the number is supposed to be somewhat larger.

The number of inhabitants is about 70,000.

The nature of the disease having been fully explained to you by the veterinary doctors who were sent out from Copenhagen by the Government early this year, I need say nothing on that subject. I met these gentlemen in different parts of Iceland, labouring to overcome the mad frenzy of the people, by getting them, under their directions, to cure the sheep. In this they have succeeded to a great extent.

From the physician-inspector at Reykjavik, I have just received a letter, in which he says,—"The sickness amongst the sheep has lessened very much, and the cured sheep are stronger than before. I have, therefore, won my battle. The Veterinary Council at Copenhagen has declared that I was quite right, and that the governors of the north and west of Iceland were quite wrong."

It is an open question whether, by curing the disease, and keeping the same number of sheep on the scanty pasture, or by killing sound and diseased alike, and thus reducing the number, the disease would have been more permanently eradicated, and one for you to determine. There can be no doubt of this, that the number might have been reduced with gain, not loss, to the country. Take the 40,000 sheep destroyed, and left necessarily where they fell, at 2s. 6d. a-head, is £5000; or 30,000 apparently sound sheep at 5s. a-head, or £7500, which is a low estimate of the value, as freight could be had to Scotland for 3s. to 5s., the latter by steamer, including hay.—Yours truly,

R. M. Smith.

5th January 1859.

From the conversation I had with the two veterinary doctors who visited me, after arriving at Leith, on their route back to Denmark, I learnt that the disease with which the sheep had been affected was the scab, and that they found it curable by the ordinary remedies. It is very probable, as Mr Smith suggests, that the remote cause of the disease was weakness from the want of proper nourishment. At the same time there is no doubt it is contagious, as it depends on acari, which readily escape from one sheep to another; but these are readily destroyed by the ordinary and well-known dressings, and a cure effected; hence the absurdity of such wholesale destruction.

RETURNS OF SEED COMPETITIONS

Held in 1859 and 1860.

Districts.	Seed exhibited in Competition by Growers to whom Silver Medals were awarded. — Names of Species and Varieties.	Quantity. Qrs.	Number of Competitors.	Award. £ s. d.	Competitors to whom Silver Medals were adjudged. — Christian Name and Surname.	Estate or Farm, and Post-Town.	Produce per Imperial Acre. Qrs.	Weight per Bushel. Lb.	Date of Sowing.	Date of Reaping.	Ground on which the Prize Seed was Grown. — Altitude. Feet.	Exposure.	Nature of Soil.
Fife.	Australian Wheat, .	3	3	1 0 0	James Lawson Millar, .	Waulkmill, Dunfermline,	4¾	65¼	Oct. 21, 1858	Aug. 9, 10, 1859	50	Southern.	Heavy black loam.
Inverness.	Chevalier Barley, . .	3	6	6 15 0	Donald Colin Cameron,	Kerrowaird, Petty, .	4	59½	April 15, 1859	Aug. 28, 1859	100	Northern.	Sandy loam.
Nairn.	Perennial Rye-grass, .	2	5	1 10 0	David Mackintosh, . .	Urchany, Nairn, . .	2½	30½	April 30, 1858	July 26, 1859	300	Level.	Gravelly loam.
	Chevalier Barley, . .	3	6	1 10 0	Alexander M'Arthur, .	Boghole, Forres, . .	6	59⅞	April 7, 1859	Aug. 22, 1859	150	Northern	Clayey loam.
	Gray Angus Oats, .	3	4	1 10 0	Alexander Robertson, .	Golford, Nairn, . . .	6	45⅛	Mar. 28, 1859	Aug. 25, 1859	200	Northern.	Clayey loam.
Stirling.	Oats—Early Blainslie,	3	18	1 0 0	Thomas Murdoch, . .	Westwood of Blair-drummond, Stirling,	6½	43	2d week of April 1859	1st week of Sept. 1859	15	Southern.	Kerse loam.
	Barley—Common, .	3	9	1 0 0	John Blair, ...	Clayhills of Touch-adam, Stirling, .	6	58¾	Middle of May 1859	Middle of Aug. 1859	50	Partly Norn.	Gravelly dryfield.
	Beans—Old Scotch, .	3	5	1 0 0	William Carrick, . . .	Baad, Blairdrummond,	4	66½	1st week of Mar. 1859	2d week of Sept. 1859	15	Southern.	Kerse blue clay.
Wigtown.	Perennial Rye-grass,	12	6	£3	Alexander Hugh M'Lean,	Auchneel, Stranraer, .	2	28	April 1858	July 1859	130	North-east	Black top on tilly bottom.
	Wheat—White Essex,	15	18		Hugh Hannay, . . .	Culgroat, Stranraer, .	8	64½	Nov. 1858	Aug. 14, 1859	30	South.	Gravelly loam.
	Oats—Potato Oats, .	12	13		Hugh Hannay, . . .	Culgroat, Stranraer, .	8	44½	Mar. 14, 1858	Aug. 1, 1859	30	South.	Gravellyloam and sharp gravel.

LIST OF PLOUGHING COMPETITIONS *reported to the Society in* 1859-1860.

District.	Date.	No of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
Aberdeenshire—						
Bogenjohn, Strichen, ...	31 Dec. 1859	32	1 rood 11 poles	4 hours	£3 0 0	James Stephen, farm-servant, Redbog.
Gibston	25 Jan. 1860	44	1 rood 25 poles	$5\frac{1}{2}$ hours	4 5 0	William Young, farm-servant, Collithie.
Kirktown, Tyrie	29 Dec. 1859	57	$\frac{1}{3}$ acre	5 hours	4 0 0	Andrew Bruce, farm-servant, Nethermill, Tyrie.
Mains of Pitfour	13 Dec. 1859	49	1 rood 13 poles	4 hours	4 9 6	John Fyvie, farmer, Wester Biffie.
Mains of Scotstown	28 Dec. 1859	30	1 rood 12 poles	$4\frac{1}{2}$ hours	7 11 6	Andrew Williamson, Stocket.
Overhills, Newhills	3 Jan. 1860	27	$\frac{1}{3}$ acre	$3\frac{1}{2}$ hours	3 12 0	John Dawson, farmer, Walton.
Westside of Brux	15 Mar. 1860	25	$\frac{1}{3}$ acre	5 hours	3 0 0	James White, farm-servant, Wester Clova.
Argyllshire—						
Ballimore	23 Feb. 1860	20	$\frac{1}{2}$ acre	5 hours	3 16 0	Duncan Smith, farm-servant, Experiment.
Dalachulish	16 Mar. 1860	15	$\frac{1}{4}$ acre	5 hours	3 14 0	Peter Sinclair, farm-servant, Achnaba.
Dalmally Farm	22 Mar. 1860	17	$\frac{1}{2}$ acre	5 hours	3 5 0	Peter M'Alpin, Soccoch.
Ganaven	9 Mar. 1860	15	$\frac{1}{4}$ acre	4 hours	3 0 0	Colin M'Callum, Baligown.
Lephenkill	14 Mar. 1860	16	$\frac{1}{4}$ acre	4 hours	3 12 0	John Buchanan, Stronafian.
Toward Farm	24 Jan. 1860	15	2 roods 6 poles	$6\frac{1}{2}$ hours	4 0 0	Robert Lamont, farmer, Little Ardyne.
Ayrshire—						
Broadyards	23 Jan. 1860	18	Rate of 1 acre Sc.	16 hours	5 10 0	Alexander Ferguson, farm-servant, Sidehead.
Craigneil	8 Feb. 1860	23	1 rood 20 poles	5 hours	4 2 6	Robert M'Caw, South Garphar.
Dumfries House Home Farm ...	21 Jan. 1860	27	1 rood 3 poles	4 hrs. 18 m.	5 7 0	John Torbet, farm-servant, Pennyfadzeoch.
East Tannacrieff	6 Mar. 1860	25	Rate of 1 acre Sc.	16 hours	5 6 0	James Wallace, Mid Collerie.
Fleminghill	8 Mar. 1860	19	1 rood 6 poles	3 hrs. 50 m.	3 12 0	David Blakely, farm-servant, Mains.
Grass Millside	14 Jan. 1860	18	Rate of 1 acre	11 hours	3 0 0	Robert Dunlop, Aulton.
Hill, Ochiltree	9 Mar. 1860	19	1 rood 5 poles Sc.	$4\frac{1}{2}$ hours	3 7 6	Daniel Kirkland, farm-servant, Lochill.
Kirkmichael	25 Feb. 1860	47	1 rood 10 po. Sc.	5 hours	3 0 0	John Bryce, Smithston.
Knowhead	24 Jan. 1860	27	Rate of 1 acre	14 hours	4 2 0	William Wyllie, Mossgeil.
Masonhill	13 Jan. 1860	24	Rate of 1 acre Sc.	16 hours	5 0 0	William Baird, farmer, Mountferguson.
New Cumnock	7 Mar. 1860	39	1 rood Scotch	4 hours	4 17 0	David Smith, farm-servant, Bank.
Sandyford	6 Feb. 1860	18	1 rood 10 po. Sc.	5 hours	4 0 0	James Anderson, junior, Kirkhill.
Banffshire—						
St Bridget	13 April 1860	18	$\frac{1}{2}$ acre	5 hours	3 3 6	James Innes, Fodderletter.
Berwickshire—						
Birgham	5 Jan. 1860	21	$\frac{2}{3}$ acre	$6\frac{1}{2}$ hours	3 15 0	George Hendrie, farm-servant, Birgham.
Cammerlaws	3 Mar. 1860	28	$\frac{3}{4}$ acre	$7\frac{1}{2}$ hours	3 17 6	James Hardie, farm-servant, Blyth.
Coldstream Mains	16 Jan. 1860	21	$\frac{2}{3}$ acre	$6\frac{1}{2}$ hours	5 10 0	James Blair, Scaithmuir.
Godscroft	13 Jan. 1860	17	Rate of 1 acre	9 hours	3 0 0	George Gillie, farm-servant, Cranshaws.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums	First Premium and Society's Medal Awarded to
Berwickshire (*continued*)—						
Harelaw...	24 Jan. 1860	16	¾ acre	6½ hours	£5 7 6	David Johnston, Causewaybank.
Linthill	24 Feb. 1860	16	¾ acre	7 hours	5 7 6	Alexander Bookless, Coldingham Law.
Ryslaw	7 Dec. 1859	22	¾ acre	6½ hours	4 10 6	James Fleming, farm-servant, Sisterpath.
Townhead	29 Feb. 1860	21	¾ acre	7½ hours	4 8 0	Thomas Galbraith, farm-servant, Neuk.
Wynfield	6 Jan. 1860	34	¾ acre	6¾ hours	5 7 6	James Veitch, Broomdykes.
Sinclair's Hill Society	20 Jan. 1860	18	¾ acre	6 hours	3 7 0	Thomas Brown, farm-servant, Greenknow.
Buteshire—						
Kerrytonlia	29 Feb. 1860	40	Rate of 1 ac. Sc.	16 hours	6 14 0	Hugh Duncan, Scoulag.
Caithness-shire—						
Latheronwheel	1 Mar. 1860	21	½ acre	5 hours	4 17 6	Benjamin Miller, farm-servant, Latheronwheel.
Sibster	13 Mar. 1860	46	½ acre	5 hours	3 15 0	Sinclair Sutherland, farm-servant, Sibster.
Dumbartonshire—						
Wallaceton	13 Jan. 1860	26	Rate of 1 acre Sc.	18 hours	3 0 0	John Glen, Wallaceton.
Woodside	17 Jan. 1860	25	Rate of 1 acre Sc.	18 hours	6 14 0	George MacAulay, Blairennich.
Dumfriesshire—						
Woodhouselees	8 Mar. 1860	23	2 roods 20 poles	6 hours	4 14 0	James Marshall, farm-servant, Glencurtholm.
Wyseby Mains	3 Mar. 1860	23	¾ acre	7 hours	3 0 0	James Dunkeld, farm-servant, Hillhead.
Wyseby Mains	3 Mar. 1860	33	¾ acre	7 hours	6 0 0	Thomas Richardson, farm-servant, Dalfibble.
Edinburghshire—						
Backhill	21 Jan. 1860	26	¾ acre	7½ hours	3 7 6	Thomas Carr, farm-servant, Crookston.
Backhill	21 Jan. 1860	44	¾ acre	7½ hours	3 10 0	Alexr. Forsyth, farm-servant, Wester Cowden.
Bryans	6 Jan. 1860	27	½ acre	5 hours	3 12 6	George Rutherford, farm-servant, Longerwood.
Harlaw	6 Jan. 1860	28	½ acre Scotch	7½ hours	5 0 0	Daniel Russell, Dales, Whitburn.
Hermiston	2 Mar. 1860	36	½ acre Scotch	7 hours	5 7 6	Robert Fleming, Rose Bank.
Shankmains	9 Dec. 1859	36	$\frac{1}{10}$ acre	1 hour	4 10 0	Thomas Brown, farm-servant, Halflakill.
Upper Dalhousie	7 Jan. 1860	25	½ acre	5 hours	3 7 6	John Inglis, farm-servant, Hardengreen.
Woolmet	8 Mar. 1860	26	½ acre	8 hours	3 11 6	Abram Ritchie, farm-servant, Longthorn.
Elgin—						
Cothall	28 Feb. 1860	24	¾ acre	6 hours	4 4 0	George Cobban, Newton of Kinloss.
Fifeshire—						
Balcormo	6 Jan. 1860	22	½ acre Scotch	5 hours	3 5 6	Robert Dickson, Balcormo.
Balquhomery	5 Mar. 1860	28	½ acre Scotch	6 hours	3 16 0	George Beath, farm-servant, Strathendry.
Drumcairns	21 Mar. 1860	22	¾ acre	6½ hours	3 0 0	William Gourlie, farm-servant, Culfargie.
Easter-Town	27 Mar. 1860	22	½ acre	5 hours	3 6 6	John Bowsie, Easter-Town.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs	Extent	Time.	Amount of Premiums	First Premium and Society's Medal Awarded to
FIFESHIRE (*continued*)—						
Middle Balbeggie	5 Jan. 1860	26	½ acre	5 hours	£4 7 0	William Johnstone, farm-servant, Bogie.
Mitchelson	17 Jan. 1860	31	½ acre	6 hours	4 2 6	Alex. Crawford, farm-servant, Middle Balbeggie.
Sheephousewell	6 Jan. 1860	39	½ acre	5 hours	3 17 6	David Adamson, farm-servant, Halbeath.
Stravithie	1 Mar. 1860	25	1 acre	6 hours	3 12 6	Robert Robertson, Carngour.
FORFARSHIRE—						
Bonnington	6 Dec. 1859	68	½ acre Scotch	6 hours	10 2 0	William Ramsay, farm-servant, The Hatton.
Dryburgh	8 Dec. 1859	36	½ acre	4½ hours	4 5 6	David Marshall, farm-servant, Neuck.
HADDINGTONSHIRE—						
Thurston Mains	6 Feb. 1860	41	¾ acre	7 hours	4 8 6	James Storey, farm-servant, Hedderwick.
INVERNESS-SHIRE—						
Groam	29 Feb. 1860	43	½ acre	5 hours	4 0 0	James Pringle, farm-servant, Beaufort Castle.
Hilton	1 Mar. 1860	23	½ acre	5 hours	4 15 0	Alexander M'Rae, Knockgar.
KINCARDINESHIRE—						
Balquharn	1 Mar. 1860	31	Rate of acre	10 hours	6 10 6	William Keith, farm-servant, Portlethen.
Mains of Fordoun	3 Jan. 1860	58	⅓ acre Scotch	4½ hours	5 12 0	David Anderson, farm-servant, Redhall.
Mountsnaught	3 Jan. 1860	23	⅓ acre	3 hrs. 20 m.	5 11 6	Adam Silver, Caviesburn.
Nether Auquhally	28 Dec. 1859	20	1 rood 5 poles	2½ hours	4 6 6	George Knowles, Glenton.
Newtonhill	4 Jan. 1860	22	Rate of 1 acre	12 hours	6 15 6	James Ross, farm-servant, Jellybrands.
Spyhill of Durris	13 Dec. 1859	40	Rate of 1 acre	10 hours	5 12 0	James Ross, farm-servant, Garrol.
KINROSS-SHIRE—						
Nuthill	6 Jan. 1860	26	½ acre Scotch	5½ hours	3 3 6	Andrew Clunie, farm-servant, Pitgorno.
KIRKCUDBRIGHT—						
Kirkbean	3 Mar. 1860	20	½ acre	5¼ hours	3 10 0	John Hooks, farm-servant, Brickhouse.
Maryfield	2 Mar. 1860	23	½ acre	4½ hours	5 4 0	David Connal, farm-servant, Ardwall Mains.
LANARKSHIRE—						
Kippbyre	12 Jan. 1860	18	½ acre	6 hrs. 40 m.	7 2 6	William Mitchell, North Medrox.
Lumloch	28 Feb. 1860	35	½ acre	6½ hours	9 2 6	William Weir, Lochfauld.
Newhouse-Mill	2 Mar. 1860	22	Rate of 1 acre Sc	17 hours	6 19 0	Mathew Leggate, farm-servant, Arnotshole
ORKNEY—						
Waltness	25 Jan. 1860	21	2 roods 1 pole	4 hours	3 11 0	Joseph Cadger, Strathore.
PEEBLESSHIRE—						
Bonnington	6 Jan. 1860	15	1 acre	8 hours	4 12 0	John Mackay, farm-servant, Eshiels.
PERTHSHIRE—						
Balinloan	27 Mar. 1860	18	¾ acre	7½ hours	3 0 6	Lorn Menzies, farm-servant, Borlick.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent	Time	Amount of Premiums.	First Premium and Society's Medal Awarded to
PERTHSHIRE (*continued*)—						
Bridge Farm	10 Mar 1860	37	½ acre Scotch	6 hours	£4 12 0	James Robertson, farm-servant, Little Fardle.
Chesthill	30 Mar. 1860	24	1 rood 20 poles	6 hours	3 0 0	John M'Lellan, Fortingall.
Comrie	16 Mar. 1860	23	1 rood 22 poles	4 hrs. 39 m.	3 0 0	Duncan M'Donald. Comrie Farm.
Craighead	1 Mar. 1860	24	⅓ acre Scotch	4½ hours	3 0 0	William Mackison, Ballingrew.
Faskally	5 Mar. 1860	37	¼ acre	7 hours	4 17 6	D. Fergusson, Dalchassen.
Fendoch	28 Mar. 1860	20	1 rood 10 poles	4 hours	4 0 0	Daniel Millar. farm-servant, Fendoch.
Methven Castle, Home Farm ...	13 Mar. 1860	27	½ acre	5 hours	4 1 0	John Graham, farm-servant, Barnyards.
Middlehaugh	12 Mar. 1860	20	½ acre	5 hours	3 2 0	Alexander Scott, Croftchurin.
Muthill	16 Mar. 1860	16	1 rood 10 poles	4 hrs. 23 m.	3 5 6	Thomas Marshall, Templemill.
Rednock	6 Mar. 1860	19	½ acre Scotch	7 hours	4 10 0	James Liddell, farmer, Lennieston.
Tarrylaw	13 Mar. 1860	25	½ acre	5 hours	4 16 0	William Davidson, Mavisbank.
Tombreck	30 Mar. 1860	22	1 rood 7 poles	4 hrs. 25 m.	3 0 0	Peter M'Donald, Carie.
RENFREWSHIRE—						
Carolside	17 Jan. 1860	29	½ acre	6 hours	5 17 0	David Brownlie, farm-servant, Kinnishead.
Drumcross	11 Jan. 1860	21	Rate of 1 acre Sc	18 hours	3 0 0	Henry Milligan, farm-servant, Rossland.
ROSS-SHIRE—						
Stornoway Mains	24 Feb. 1860	17	¾ acre	7 hours	3 5 0	Donald M'Kay, farm-servant, Melbost.
ROXBURGHSHIRE—						
Deanfoot	17 Jan. 1860	35	¾ acre	6 hours	10 0 0	Edward Telfer, Clarilaw.
Middlethird	7 Mar. 1860	26	¾ acre	8 hours	6 10 0	David Reid, Greenknowe.
Sunlawshill	29 Feb. 1860	47	¾ acre	6 hours	18 0 0	Andrew Hogg, Kersmains.
SELKIRKSHIRE—						
Lindean	25 Jan. 1860	18	½ acre	5½ hours	4 15 0	Walter Shakleton, farm-servant, Netherbarns.
STIRLINGSHIRE—						
Airdriehead	13 Jan. 1860	23	2 roods 3 po. Sc.	10 h. per ac.	3 11 6	John Mills, farm-servant, Smithstown.
Arnprior	29 Feb. 1860	23	Rate of 1 acre Sc.	14 hours	5 0 0	John Murdoch, Laraben, Arnprior.
Auchinbowie Mains	25 Feb. 1860	25	½ acre	4 hrs. 50 m.	4 7 6	Alexander Legget, Bankhead.
Coldoch	24 Jan. 1860	30	½ acre	7½ hours	5 9 0	John Bowie, Coldoch.
Westlees	12 Jan. 1860	27	Rate of 1 acre Sc.	15 hours	4 17 0	James M'Leay, Manorneuck.
WIGTOWNSHIRE—						
Barglass	10 Jan. 1860	45	½ acre	4 hours	9 0 0	James Parker, farm servant, Baldoon.
Kirkmabreck	23 Jan. 1860	54	½ acre	5 hours	5 2 6	Thomas Black, Craigencrosh.
Low Torrs	3 Mar. 1860	30	1 rood 30 poles	4½ hours	5 2 6	Robert Kerr, Droughdool.
Monreith	12 Jan. 1860	74	Rate of 1 acre	10 hours	8 7 6	Daniel MacWilliam, Cairnfield.
Mull of Galloway	25 Feb. 1860	42	½ acre	5 hours	4 7 6	John Mackay, Logan.

PROCEEDINGS IN THE LABORATORY.

By Professor Anderson, M.D., Chemist to the Society.

ON THE COMPOSITION OF THE TURNIP AT DIFFERENT PERIODS OF ITS GROWTH.

(*Continued from page* 320.)

In the fourth stage of its existence, the constituents of the turnip were divided between the leaves and bulbs in the following proportions:—

	Leaves.	Bulbs.
Water,	12,392 lb.	41,621 lb.
Albuminous compounds,	307 „	457 „
Other organic matters,	1,048 „	2,995 „
Ash,	263 „	917 „
	14,010 „	45,990 „

	Leaves.	Bulbs.
Nitrogen,	49.2	73.2
Peroxide of iron,	7.03	12.59
Lime,	17.81	111.14
Magnesia,	36.16	45.58
Potash,	40.75	257.04
Soda,	...	62.54
Chloride of sodium,	46.91	88.12
Phosphoric acid,	29.82	93.17
Sulphuric acid,	36.69	119.84
Carbonic acid,	38.80	98.48
Silicic acid,	9.43	28.50
	263.40	917.00

The changes which the crop has now undergone are not less remarkable than those which have occurred during the previous periods of its growth. It is more especially noticeable that the leaves, in place of increasing, have actually made a retrograde movement, having lost in weight nearly 10,000 lb., and exactly one-tenth of this quantity of solid matters. This diminution, at first sight very inexplicable, is no doubt chiefly due to the decay of the outer leaves of the plant, which always occurs in autumn, and in this case had taken place to a very marked extent during the broken and unsettled weather, with pretty severe night frosts, which preceded the collection of the plants. It is possible, also, that it may depend, to some extent, in the transference of part of their solid constituents to the bulbs. The period of active growth having come to an end, a portion of the sap, which previously circulated through the leaves, may be withdrawn from them. It is impossible to submit this view to actual proof; but, at all events, it draws some support from the slight diminution in the per-centage of water contained in the leaves. The bulbs during this period were advanced with remarkable rapidity, and gained no less than 27,990 lb., or at the rate of 799 lb. per diem, containing 73.4 lb. of solid matters. When, however, the loss of weight of leaves is taken into account, the absorbed increase of solid matters in the whole plant was at the rate of 44.8 per day, which is only about one-third of the daily gain during the preceding period.

It was my intention to have prosecuted the investigation of the turnip during the remainder of its growth, and more especially to have traced the changes occurring during the production of its flower and seed. Unfortunately, however, I was prevented doing so, because, very soon after the last specimens were taken, the crop was sold, and at once cleared off the ground to make way for winter wheat; and as the plot selected for my experiments—on the ground of its being suitable in point of soil, appearance of crop, &c.—happened to be near the centre of the field, it was impossible to preserve it, and the crop was removed along with the rest. A small plot might have been retained in the corner of the field; but as the turnips there had been sown some days later than the rest, and as from other circumstances it could not be considered to represent the average, I resolved, after mature consideration, to discontinue my experiments at this point—the more especially as they include the most important part of the history of the crop in an agricultural point of view—and to trust to some future opportunity to fill up what has been unavoidably left incomplete.

It now remains for me to discuss the observations contained in the preceding pages—and, first, as to the produce. The season, on the whole, was unfavourable to the turnip, having been unusually dry in many parts of the country. The neighbourhood of Kirkintilloch, however, did not suffer to so great an extent as many other places; and the field in which my experiments were made lying low, the crop, though not excessive, was fair, and above the average of the whole of Scotland, as deduced from the agricultural statistics collected some years since. On the experimental plot it amounted to 20 tons 10 cwt. per Scotch acre, or 15 tons 8 cwt. per imperial acre. The produce over the whole field was 19 tons per Scotch acre. The difference is due to the fact that, though the plot when selected at the time of thinning appeared a perfectly fair average of the field, it afterwards showed a slight superiority. It will be readily understood that it is impossible at an early stage of its growth to select a part of any crop as the average which may not afterwards turn out very differently from what was expected. In this case, indeed, the difference is inconsiderable; and as all the analyses and calculations refer to the one plot, they are strictly comparable, and represent the successive stages of a crop which reached 20½ tons per Scotch acre.

In examining the composition of the turnip at the four successive stages, a very remarkable uniformity is observed in all except one particular. In the third stage a great diminution appears in the per-centage of albuminous matter in the leaves. This is so great that I cannot doubt that an error has crept in here; but, unfortunately, the remainder of the leaves had been incinerated for ash before it was discovered, and I was therefore precluded from repeating the determination of this constituent. I have given the result as obtained, although I do not venture to draw any conclusions from it.

TABLE giving the PER-CENTAGE COMPOSITION and PRODUCE per Imperial Acre of the TURNIP-CROP at Four different Periods of its Growth.

Period.	No. of Days.	Per-Centage Composition.			Ash.	Total quantity in lb. of each constituent per imp. acre.					Total Weight per Acre.	Daily Gain in Weight.	Daily Gain of dry Matter.
		Water.	Albuminous Compounds.	Other Organic Matters.		Water.	Albuminous Matters.	Other Organic Matters.	Ash.	Nitrogen.			
Leaves													
1	32	92.08	2.51	4.79	0.62	202.20	5.31	10.83	1.36	0.85	219.	6.8	0.55
2	35	90.90	1.84	5.38	1.88	11571.	225.	775.	184.	36.	12793.	35.8	34.40
3	20	89.10	0.76	8.19	1.95	17106.	1720.		375.	...	19200.	320.0	43.5
4	35	88.45	2.40	7.27	1.88	9914.	246.	839.	211.	39.	11208.	...	...
Bulbs													
1	32	81.13	6.31	9.22	3.34	6.02	0.45	0.72	0.24	0.07	7.2	0.22	0.03
2	35	89.90	1.06	8.16	0.88	2547.	33.	157.	25.	5.3	2762.	78.	6.1
3	20	90.02	1.40	7.55	1.02	12960.	220.	1072.	147.	32.3	14400.	581.	61.2
4	35	90.50	1.18	6.33	1.99	33297.	366.	2396.	73.4	58.6	36792.	639.	71.3

In order to place the progress of the crop more clearly before the eye, I have arranged the results of my experiments, reduced to the imperial acre, in the preceding table. In examining this table we observe, in the first place, that the leaves and bulbs form in many respects a remarkable contrast. At the first stage of their development, the former contain less than 8 per cent of solid matters, which gradually increases up to above 11½ at the last stage. On the other hand, the roots at the first stage contain by much the largest quantity of solid matters, the per-centage being nearly 19, but it rapidly falls to about 90, at which it remains nearly constant during the remainder of the season. The diminution in the solid matter is connected with the development of the bulb, and the accumulation of the cellular tissue in it. At the first stage the roots were slender fibres, penetrating pretty deeply into the soil; but at the second stage they had expanded to an inch or more in diameter. The changes in the quantity of albuminous compounds is still more remarkable, for they fall from 6.31 to little more than 1 per cent, at which they remain during the whole of the subsequent growth of the crop. The leaves at first contain little more than a half per cent of ash, which, however, soon rises to three times that quantity, and thereafter remains unchanged. In the case of the roots an opposite result takes place, for at their first stage they contain 3.34 per cent of ash, which in the second stage diminishes to one-fourth of that quantity, but again rises gradually, and at length reaches about 2 per cent.

When the gain in weight per acre is considered, it is obvious that the plant commences its growth by developing its leaves, which advance with extraordinary rapidity during the period of most active growth, and most rapidly during the second period. In the third stage, their daily progress is somewhat smaller; and during the last, when the bulbs advance most rapidly, there is a positive diminution in the weight of leaves. The bulbs, on the other hand, advance comparatively slowly during the second stage, and the rapidity of their daily gain increases up to the end of their growth. In the fourth period, they weigh about 2½ times as much as in the third, and 13 times as much as in the second.

The composition of the ash also shows some interesting changes. They will be most readily rendered apparent by the following table:—

TABLE giving the PER-CENTAGE COMPOSITION of the ASH of the LEAVES and BULBS of the TURNIPS at the different Stages of Growth.

LEAVES.	1st stage.	2d stage.	3d stage.	4th stage.
Peroxide of iron,	5.27	2.87	2.26	2.67
Lime,	22.12	14.61	13.05	6.76
Magnesia,	5.97	6.99	7.39	13.73
Potash,	10.39	17.22	23.30	15.47
Soda,	0.22	2.78	...	...
Chloride of sodium,	11.38	11.54	14.96	17.81
Phosphoric acid,	11.02	12.29	10.46	11.32
Sulphuric acid,	9.58	15.64	12.88	13.93
Carbonic acid,	14.01	13.04	12.96	14.73
Silicic acid,	9.86	3.02	2.74	3.58
	100.00	100.00	100.00	100.00

BULBS.	1st stage.	2d stage.	3d stage.	4th stage.
Peroxide of iron,	5.35	2.24	1.39	1.37
Lime,	12.49	8.55	8.55	12.12
Magnesia,	8.38	4.09	4.00	4.97
Potash,	19.59	32.29	29.21	28.03
Soda,	4.27	10.02	5.02	6.82
Chloride of sodium,	8.58	7.76	8.97	9.61
Phosphoric acid,	11.45	12.22	11.09	10.16
Sulphuric acid,	9.62	9.25	16.68	13 07
Carbonic acid,	10.74	11.03	12.36	10.74
Silicic acid,	9.54	2.55	2.73	3.11
	100.00	100.00	100.00	100.00

Taking the individual constituents, it is to be observed that the per-centage of lime, which is larger in the early stage of growth of the leaves, steadily diminishes until it falls to less than 7 per cent, or one-third of its original proportion, while magnesia increases as the plant advances towards maturity. Potash, forming at first 10 per cent of the ash, rapidly increases, and then again diminishes, in the last stage. Chloride of sodium (common salt) likewise increases, while phosphoric and sulphuric acids remain nearly the same at all periods. In the bulbs, on the other hand, lime diminishes during the middle stages, and at the end rises to its original proportion. Magnesia, which amounts to 8 per cent at the period of thinning, falls to about half that quantity, and retains this proportion unchanged to the close of the growth of the plant. Potash, which at first amounted to only 19.59 per cent, increases at once to upwards of 30, and afterwards undergoes a slight diminution. Phosphoric acid is nearly constant throughout the whole season, and sulphuric acid shows a slight increase in the two last stages.

Much more instructive, however, is the consideration of the absolute weights of those different substances withdrawn from the acre of land, which is given in the following table:—

TABLE giving the ACTUAL QUANTITIES of each Substance contained in the ASH of the TURNIPS growing on an Imperial Acre of Land at the Four different Periods of its Growth.

	1st stage. grains.	2d stage. lb.	3d stage. lb.	4th stage. lb.
LEAVES.				
Peroxide of iron,	501.6	6.86	8.44	5.60
Lime,	2105.8	34.92	48.84	14.24
Magnesia,	568 3	16.68	27.64	28.92
Potash,	989.1	41.16	87.24	32.60
Soda,	20.9	6.64	...	...
Chloride of sodium,	1082.4	27.56	57.60	37.52
Phosphoric acid,	1068.0	29.40	39.08	23.84
Sulphuric acid,	911.0	37 40	48 20	29.36
Carbonic acid,	1333.6	31.16	48.52	30.04
Silicic acid,	93.88	7.20	10.32	7.52
BULBS.				
Peroxide of iron,	89.8	0.55	2 04	10.08
Lime,	208.9	2.12	12.60	88.92
Magnesia,	132.8	1.00	5.88	36.44
Potash,	328.0	8.00	43.12	205.64
Soda,	70 9	2 48	7.40	50.04
Chloride of sodium,	144.0	1.92	13.24	70.48
Phosphoric acid,	191.5	3.02	16.36	74.52
Sulphuric acid,	160.8	2.30	24 60	95.84
Carbonic acid,	181.9	2.75	18.24	78.76
Silicic acid,	165.6	0.63	4.54	22.80

Directing our attention more particularly to the substances contained in the bulbs, which have a greater importance as being the part actually removed from the soil, we cannot fail to be struck with the extraordinary rapidity of increase during the last stage. In the thirty-five days which elapse between the third and fourth analyses, the quantity of lime and soda has increased sevenfold, magnesia sixfold, potash and phosphoric acid fivefold, and sulphuric acid fourfold. Of course the quantity removed from the soil has not advanced in so rapid a ratio, because the leaves have diminished greatly in weight during the last stage, but still the quantity absorbed has been extremely large, the plants having within that period absorbed 198 lb. of potash, 43 of phosphoric acid, and a proportionate quantity of their other constituents.

A minute examination of the preceding tables opens up many important considerations bearing upon the question of the nature of the manure applied to turnips. It is scarcely necessary to observe, that the view commonly taken regarding the *rationale* of the use of all manures is, that they must supply those substances which the plant especially demands, and which the soil offers to it in smallest quantities. The truth is, however, that when we come to look at the manures which are most commonly employed, we find that they consist mainly of ammonia and phosphoric acid, and that those substances invariably produce a marked and unmis-

takable effect on the crops to which they are applied, while all the other substances, so far as our present experiments go, are very uncertain, and often quite ineffective. This is particularly the case with potash, which, though sometimes producing a very striking effect, has generally proved altogether useless; and yet, if we were to draw our conclusions from the composition of the ash of the turnip, we should be led to draw the conclusion that it ought to be the most essential constituent of any manure applied to it. It is notorious, however, that potash compounds are not used as manure for the turnip, and that guano is nearly, and superphosphates altogether, devoid of that substance. We are forced, therefore, to admit that the composition of the ash is not, at least as far as our present knowledge goes, a guide to the substance or substances to be especially selected as manures, and we return to the old statements of the preponderating importance of ammonia and phosphoric acid. No doubt these other substances must all be useful, because they serve to maintain the supply necessary for the continued fertility of the soil; but as far as the effect on the crop to which they are applied is concerned, they seem to have little influence. At the present moment it must be admitted that, notwithstanding all the experiments which have been made, our ideas regarding the mode of action of manures are extremely crude. A broad general statement has been made, to the effect that ammonia is specially suited to the cereals, and phosphates to the turnip, but the effect of other substances has been most imperfectly examined. Accurate and extended experiments on the turnip with potash salts are still required; and it would be most desirable to extend our inquiries beyond the often repeated experiments in which the manures of different makers, almost all of which are manufactured on precisely the same principles, are pitted against one another, the results of which are more advantageous to individual manufacturers than to either the practice or the science of agriculture. It would be far better if the farmer would undertake experiments calculated to throw light upon the principles of manuring. Now, in regard to the turnip, there are many points requiring investigation. Thus, for instance, it is known that an ordinary superphosphate will often produce a better result than an equal weight of Peruvian guano, which contains about the same quantity of phosphates, and perhaps ten times as much ammonia—nay, it will even surpass a phosphatic guano containing nearly twice as much phosphates. It has been usual to attribute this to the greater solubility of the phosphates in a superphosphate, which admits of their being more uniformly distributed through the soil; but this cannot be the sole reason, because Peruvian guano contains a considerable quantity of phosphoric acid in a soluble condition, and even its insoluble phosphates are in a comparatively accessible state. We must look,

therefore, to some other cause. Now there is one constituent of the turnip to which little attention has hitherto been directed, although it is a most abundant one, indeed one of the most abundant. The analyses already given show that the turnip, at its last stage of growth, contains no less than 125 lb. of sulphuric acid, being, next to potash, its most abundant constituent. But the quantity of sulphuric acid in the ash gives a very inadequate idea of the whole amount of sulphur required by the turnip, for it contains also a volatile oil of which sulphur is one of the components, and the smell of a turnip-field is due to the exhalation of that oil. There is here, therefore, a constant consumption of sulphur, which is derived from sulphuric acid contained in the soil, the amount of which we have no means of estimating, but which is, doubtless, far from inconsiderable. Now sulphuric acid is found very sparingly in most soils, and it may be inquired whether part of the effect produced by superphosphates may not be due to the sulphate of lime they contain. The same consideration would help also to explain the anomalous fact that phosphatic guanos of very low quality, which often contain sulphate of lime, are occasionally found to produce a striking effect on the turnip.

Whatever views we may entertain regarding the mode of action of manures, it must be admitted that the subject is far from exhausted, and that the minute study of the composition of different crops will open up many important points requiring to be elucidated by experiment.

ON THE COMPOSITION OF OIL-SEEDS.

In a recent Number of the Transactions I published a series of analyses of different kinds of oil-cake, the object of which was to show that there are, besides the familiar linseed and rape cakes, a variety of others, some of which, when price and nutritive value are taken into account, may be usefully employed by the farmer; while there are others made from seeds which act injuriously on the animal system, and produce bad effects and even the death of the animals fed upon them. As belonging to the former class, earth-nut, poppy, teel, sunflower, and niger cakes may be mentioned; while the latter are illustrated by East Indian rape-cake and cress-cake, as well as by those containing the refuse of mustard seed. The events of the past winter have still further increased the importance of this subject, and have shown how desirable it is that the supply of cattle food should be increased; and any facts likely to encourage the importation of oil-seeds or other foreign produce which may be turned to that purpose, must be a matter of much interest to the agricultural public. It is clear, from the analyses contained in the paper just alluded to, that there are substances which might be imported with advantage to the farmer, but it is also necessary for him to exercise a careful scru-

tiny over what is offered to him, in order to make sure that they are not injurious. As a proof of the fact, it may be stated that, in consequence of my having directed the attention of farmers to East Indian rape-cake, and its injurious effects, several samples have been submitted to me by members of the Society, which had been supplied for feeding purposes, and which consisted in whole or part of that seed Fortunately the difference had been detected before they had been used, and the purchasers were saved the loss and injury which would unquestionably have been sustained had they been given to cattle. In one instance, the facts which I had ascertained were represented to the seller, who at once admitted that the article sold to his customer was made from East Indian rape, and stated that, had he known it was to be used for feeding it would not have been supplied, but the proper feeding rape-cake would have been furnished.

It is not possible to obtain any definite information regarding the quantities of the less common oil seeds imported into this country, but it is trifling, although very large supplies of some of them might be obtained. Teel or sesamum, for instance, is one of the most abundant and widely distributed crops in all eastern countries, and should a demand for it spring up in this country, it might be supplied in almost unlimited quantity. At present many circumstances tend to prevent their importation. The oil-crushers are unwilling to use seeds with which they are not familiar, partly because of the uncertainty of the supply, and partly because there is some difficulty in getting rid of unfamiliar oils and cakes, and there is too much reason to fear that the small quantities imported are used to adulterate the more expensive articles, and to produce an inferior oil and cake. The introduction of new oil-seeds into commerce is a matter which very much depends upon the farmer; for in the more familiar seeds, such as linseed and rape, the value of the cake often exceeds half that of the seed, and the price obtainable for it is a matter of the utmost moment to the manufacturer, who cannot afford to use a seed unless he can sell the cake to the farmer. He must be guided also by the proportion of oil the seed will yield in the press, and hence a knowledge of the quantity of that substance contained in them is of importance to him. A knowledge of the composition of these oil seeds is important also to the farmer, because it is quite possible that some of them may be sufficiently low-priced to permit them to compete advantageously with linseed, which is occasionally used, more particularly for feeding calves, although its high price necessarily restricts its employment. In order to obtain data to assist both the oil-crusher in the probable profit to be derived from the use of particular seeds, and to induce the farmer to make trial of some of them as substitutes for linseed, I have made the analyses which form the subject of this paper.

As linseed must necessarily be the standard to which all the others are referred, an average analysis of that substance may be given in the first instance. It contains—

Water,	7.50
Oil,	34.00
Albuminous compounds,	24.44
Gum, sugar, &c., Fibre,	30.73
Ash,	3.33
	100.00
Nitrogen,	3.91

In this analysis the amount of fibre was not separately determined, but it has been done in all those which follow.

English Rape-seed.—The sample was of good quality. It gave—

Water,	7.12
Oil,	36.81
Albuminous compounds,	21.50
Gum, mucilage, sugar, &c.,	28.73
Fibre,	6.86
Ash,	8.97
	100.00
Nitrogen,	3.44

There is therefore little difference between linseed and rape—for the slight inferiority in the albuminous compounds is in all probability fortuitous—and it may be fairly assumed that, just as in the case of the cakes, the average would be much the same. I am not aware that rape-seed has ever been used for feeding in this country, but there seems no good reason why it should not be tried. It is very much cheaper than linseed, and its bitter taste, which often deters cattle from eating it, would be less perceptible than in the cake, owing to the larger quantity of oil.

Earth-nut (decorticated).—The specimen was a portion of that which had been used for manufacturing the cake already analysed. Its outer shell had been removed, and it was exactly in the state in which it went into the press. Its analysis gave—

Water,	6.24
Oil,	41.23
Albuminous compounds,	28.25
Gum, mucilage, sugar, &c.,	7.16
Fibre,	13.87
Ash,	3.25
	100.00
Nitrogen,	4.52

Here the proportion, both of albuminous compounds and oil, is very considerably higher than in either linseed or rape, and as these are the constituents in which the value of an oil-cake is usually believed to depend, it may be fairly anticipated that, used as food, the earth-nut would prove highly nutritive. Its taste is not unpleasant, and not very different from that of linseed, and, though somewhat

rancid, it is not so much so as to render it unpalatable to cattle. I do not know the price at which it could be imported into this country, but it is cheaper than linseed.

Cotton-seed (*decorticated*).—This specimen also consisted of part of that used for the manufacture of the cake, of which the analysis is contained in the paper already referred to. It contained—

Water,	6 57
Oil,	31.28
Albuminous compounds,	31.86
Gum, sugar, &c.,	14 82
Fibre,	7.30
Ash,	8·91
	100 00
Nitrogen,	4.97

In this seed the oil is smaller, and the albuminous compounds larger, than in any of the previous ones. The latter especially are higher than in the best linseed-cake, and it would therefore be a matter of much interest to have some experiments made on cattle with the view of comparing the nutritive effects of these two substances.

Dotter-seed.—This is a small yellow seed, which is rich in albuminous compounds, though rather poor in oil. It contains—

Water,	5.75
Oil,	28.18
Albuminous compounds,	28.31
Gum, sugar, &c ,	12.16
Fibre,	9.05
Ash,	11.55
	100.00
Nitrogen,	4.53

The taste of this seed is extremely strong and turnipy, and hence it is inapplicable to feeding of milch cows, as it would unquestionably communicate its flavour to the milk; but, except for this disadvantage, it ought to be highly nutritive.

Niger-seed (*Guizotea Oleifera*) contains—

Water,	7.02
Oil,	43.22
Albuminous compounds,	19.37
Gum, sugar, &c.,	12.37
Fibre,	14.33
Ash,	3.48
	100.00
Nitrogen,	3.10

This seed is admirably adapted for the oil-presser, owing to the large quantity of oil it contains; but it is less suited for feeding purposes than the last. The albuminous or flesh-forming constituents are less abundant, and the fibre is comparatively large. It is also a somewhat hard seed, with a pretty firm husk, and hence may, in all probability, prove less digestible; but still in this re-

spect it may compare favourably with many of the substances on which cattle thrive satisfactorily.

Teel or *Sesamum Seed.*—The specimen of this seed analysed was obviously of inferior quality; it was small and dirty, and the kernel very much shrivelled up. Its composition must not, therefore, be taken as representing the usual average. It contains—

Water,	4.54
Oil,	37.02
Albuminous compounds,	18.87
Gum, Sugar, &c.,	19.13
Fibre,	11.71
Ash,	8.73
	100.00
Nitrogen,	3 02

Sunflower Seed.—The sunflower belongs to the same natural family of plants as the Niger, and the two seeds present many points of resemblance. The sunflower has a thick husk, and hence a very large quantity of fibre appears in the analysis, which gave—

Water,	6 19
Oil,	34.74
Albuminous compounds,	13 29
Gum, sugar, &c,	23.95
Fibre,	28.48
Ash,	3 35
	100.00
Nitrogen,	2.13

In this case the oil and albuminous compounds are low, and the value of the seed for feeding purposes, as well as for the manufacture of oil, is comparatively small.

On comparing the analyses of these seeds, all of which contain bland oils, and may be used either in their natural state or as cake for the food of animals, we are naturally struck by the great diversity of their composition, the oil varying from 24 up to 43 per cent, and proportionate differences being observed in their other constituents. When the structure of the seeds is examined, these differences are easily accounted for. In all oil-seeds it is the kernel which contains the oil, as well as the albuminous compounds, in largest quantity; and hence it follows that, if the seed is sufficiently large to admit of decortication, the kernel must necessarily contain a much larger quantity of valuable matter, and yield a superior cake to those obtained where the whole seed must be expressed, and the value of the entire seed must depend on the ratio the husk bears to the kernel. It is for this reason that the earthnut and cotton-seed are so superior to the others; and it is also the cause of the difference between the thin-skinned dotter-seed with its 9 per cent of fibre, and the sunflower with its thick husk adding 28 per cent of useless and innutritious matter to the bulk of the seed. The general inference which may be drawn

from these analyses is, that the interests of the oil-crusher and the farmer are at one in the matter of oil-seeds, those which yield the largest quantity of oil also giving the cake best fitted for feeding purposes. It is obvious, also, that, as far as the analytical results are concerned, there is no reason why the farmer should not use some of these seeds for feeding-purposes, provided the price is suitable. I regret to say that on this, the commercial aspect of the question, I have no definite information, although I know generally that most of them are materially cheaper than linseed. It will be understood, however, that there is another question which must never be left out of consideration in the case of substances used for feeding, which is, that however unexceptionable in composition, they may be unpalatable to the animal. It is this that makes the difference between linseed and rape-cake, and no one can venture to express an unhesitating opinion regarding any food, until experiment has shown that it is suited to the animals. The effect a food produces upon the animal is often due to flavour, or to the presence of infinitesimal traces of substances which evade detection. The nutritive matters are the same in all foods, but it depends upon their flavour whether they are readily eaten, or whether they are so repulsive that the animal avoids them until the calls of hunger become irresistible. In the latter case, of course, they fail to produce that effect which was to be anticipated from the amount of nutritive matters contained in them. Hence it must be borne in mind that the conclusions we draw from the preceding analyses, are to be viewed in the light of suggestions for experiments; and it is greatly to be desired that, when opportunity offers, some of these seeds should be tried on the farm.

I may add to these the analysis of a sample of yellow Guzerat rape-seed, which is totally unfitted for food, because it contains an acrid principle similar to that existing in common mustard. It is in fact a species of Sinapis, and the seed in its external appearance closely resembles common yellow mustard. It contains—

Water,	5.60
Oil,	45.51
Albuminous compounds,	15.50
Gum, sugar, &c.,	14.58
Fibre,	15.31
Ash,	3.50
	100.000
Nitrogen,	2.40

In this case the oil is abundant, and the cake would fetch a moderate price as a manure.

In my paper on the different kinds of oilcake, I have described several other seeds, but have not yet had an opportunity of examining the seeds from which they are obtained, but hope to be able to do so at some future period.

NOTES ON SOME VARIETIES OF GUANO.

I have taken occasion from time to time to communicate to the Society any matters of interest which occur in relation to the guanos imported into this country. Every year some new deposits are discovered, or some peculiarities are observed in cargoes brought from well-known localities, which are worthy of notice. It often happens that the guano imported under a particular name one year is totally different from that met with the next, and the farmer, relying upon his experience in past seasons, may be greatly misled in this way. The reason is, that most guanos are met with in small deposits, scattered over a wide stretch of coast, each of which may differ very greatly. Peruvian guano is the only one which is all found in one locality, and which presents a general uniformity, though even in it the differences in value are much greater than is generally supposed. If differences are found to exist in a deposit accumulated under circumstances so favourable to uniformity as the Chincha Islands, it may be easily understood how great the differences must be in the case of Patagonian, and other similar guanos, of which two different cargos may be brought from localities several hundred miles apart, and the necessity for caution on the part of the purchaser is obvious.

The guanos which have been imported during the present season may be said, on the whole, to contrast favourably with those of some former years. There appears to have been less than the usual quantity of worthless guanos, although a good many cargoes containing 40 or 50 per cent of sand, carbonate and sulphate of lime, and other worthless matters, have come under my notice. On the other hand, there have been more *good* phosphatic guanos than have been seen for some years, although the supply of really valuable guanos of this kind is by no means equal to the demand. Very few guanos of this kind equal to Saldanha Bay are now to be found in the market, although there are some not very much inferior to it.

Ichaboe Guano.—Some years have elapsed since I have seen this variety; but within the last two months two samples have been sent to the laboratory, which, having come from the same neighbourhood, I think it probable are both from one cargo. Their composition was—

	I.	II.
Water,	15.31	25.54
Organic matter and ammoniacal salts,	48 17	46.62
Phosphates,	16.55	12.24
Sulphate of lime,	...	3.67
Carbonate of lime,	1.14	...
Alkaline salts,	6 50	7.98
Sand,	12 33	3 95
	100.00	100.00
Ammonia,	13.97	15.61
Phosphoric acid and the alkaline salts,	0.23	
Equal to phosphate of lime,	0.49	

These two samples are obviously very recently deposited, and they differ remarkably from the older Ichaboe, which contained about 35 per cent of phosphates, and only 7 or 8 of ammonia. They bear a closer resemblance to Peruvian guano in composition, and they somewhat resemble it in colour, though moist and pasty in consequence of the moisture they contain. This was particularly the case with No. 2, which was quite wet, and could be squeezed into balls in the hand. Notwithstanding the large proportion of water, its value approaches that of Peruvian guano, and it is worth from £11 to £11, 10s. per ton. In point of fact, cargoes of genuine Peruvian guano are occasionally imported which are little if at all superior to this, although they are sold at the usual price of £13 per ton.

Pacquico Guano.—A guano has been recently imported under this name, which contains a larger quantity of ammonia than is usually met with at present. It is remarkable for the abundance of alkaline salts (consisting chiefly of common salt) which is found in it. Part of it is often found in the form of hard saline lumps, which are particularly rich in salt. The following are analyses of different samples :—

	I.	II.	
		Powder.	Lumps.
Water,	9.54	13 45	3 60
Organic matter and ammoniacal salts,	30.54	26.97	25.47
Phosphates,	18.43	25 77	10 30
Sulphate of lime,	0 93	3 28	2.43
Alkaline salts,	34 58	25.10	54 38
Sand,	5.98	5.43	3.82
	100 00	100.00	100.00
Ammonia,	6 51	6.54	5 97
Phosphoric acid in the alkaline salts,	3 33	4.10	3.71
Equal to phosphate of lime,	7.15	8.88	8.05

An unusual feature in this guano is also the large quantity of phosphoric acid it contains in the alkaline salts, which is so considerable that it partakes to some extent of the characters of a super-phosphate. If we estimate this phosphoric acid at the same rate as that used in the valuation of the soluble phosphates in a superphosphate, then it adds from £2, 5s. to £2, 12s. to the value of a ton. The entire value of the powdery part of No. 2 is about £8, 10s. per ton. That of the lumps, and of No. 1 of course, is somewhat less. This guano is very different from any which has hitherto been imported, and it would be very desirable that persons who may have used it should make known the results it has yielded in the field.

Two other guanos, from localities not stated, similar to this kind in all respects, except in the quantity of phosphoric acid in the alkaline salts, contained—

	I.	II.
Water,	26.25	10.15
Organic matter and ammoniacal salts,	33.75	30.69
Phosphates,	23.27	30 50
Sulphate of lime,	„	1.11
Alkaline salts,	13.84	18.14
Sand,	3.39	9.41
	100.00	100.00
Ammonia,	8.04	6.34
Phosphoric acid in the alkaline salts,	0.94	1.61
Equal to phosphate of lime,	2.04	3.48

A very remarkable guano has recently been imported into this country from a new locality, which is kept secret. It is distinguished by its dark-brown colour, and its earthy smell, quite unlike that of all other guanos, and by its consisting entirely of little grains varying in size from that of a mustard-seed to a small pea. It contains—

Water,	9 51
Organic matter and ammoniacal salts,	11.63
Phosphates,	55.40
Oxide of iron,	20.22
Alkaline salts,	trans.
Sand,	3.24
	100.00
Ammonia,	0.48

The occurrence of oxide of iron in a guano, at least to so large an extent, is a very unusual occurrence, and is important in so far as it might lead to a considerable error in the determination of the phosphates in the hands of a careless analyst. Of a phosphatic guano it is a good specimen, and it will undoubtedly be found useful on light soils, and generally in those places where phosphates are particularly required. I have been unable to obtain any definite information regarding the mode in which this guano occurs, or the cause of the presence of oxide of iron. I may state, however, that the oxide is apparently hydrated, and is uniformly distributed through the guano in a fine state of division. This guano is said to be found in a considerable deposit, and it can be imported at a moderate cost, so that it is likely to find its way into commerce.

The following are analyses of a kind of phosphatic guano which has not been imported to any great extent of late years, but for which a very large demand would be found if its price were moderate:—

	I.	II.
Water,	14.65	8.70
Organic matter and ammoniacal salts,	27.02	16.90
Phosphates,	50.37	55.79
Carbonate of lime,	1.40	9.29
Alkaline salts,	5.54	4.94
Sand,	2.02	4.38
	100.00	100.00
Ammonia,	3.21	2.27

I believe these to be samples of Bolivian guano, although I have no definite information on this point. They are undoubtedly good samples of phosphatic guanos, but their use is a question of price. Hitherto Bolivian or Upper Peruvian guano, as it is also called, has been a high-priced article, often sold for as much as £10 or £11 per ton. Now, the guano containing oxide of iron, I am given to understand, can be imported with profit for about £6 per ton, and if so, the last mentioned guano ought to be sold for about £8, or £8, 10s. When they are sold above this price they may be considered dear as compared with other guanos of the same class.

Another very fine phosphatic guano contained—

Water,	5.75
Organic matter and ammoniacal salts,	13.84
Phosphates,	65.40
Sulphate of lime,	5.16
Alkaline salts,	0.76
Sand,	9.09
	100·00
Ammonia,	0.87

The use of phosphatic guanos is a subject in regard to which much difference of opinion exists among practical men. It is well known that there are many parts of the country in which they surpass Peruvian, but on the other hand, the experience of farmers in other places is in favour of Peruvian, much depending on soil, position, &c. It is not unfrequently stated that chemists have depreciated phosphatic guanos, but I do not think this can be fairly laid to their charge. What they have said is, that a certain method of valuation applied to Peruvian guano estimates it at almost exactly the price at which it is sold, but the *same system applied to phosphatic guanos* gives them a value much below their market price. The truth is, that the value of any article is estimated by the price it brings in the open market; and, in general, the profit derived from it can be easily and accurately estimated. But in agricultural matters many difficulties are encountered in doing this, and hence discrepancies are met with, which it is difficult or impossible to explain. It may be alleged, that when we compare a Peruvian and a phosphatic guano, we take substances between which no true comparison can be instituted; and this will be freely admitted, because it is obvious that they operate in different ways. But how are we to reconcile a difference, to the extent of £4 or £5 per ton, between two phosphatic guanos, containing their valuable constituents in nearly the same proportions? It is clear, in fact, that, commercially, the value of a guano is not fixed according to the quantity of valuable matter it contains, but by considering the price the farmer can be prevailed upon to pay for it. The farmer, therefore, has really the determination of the price he has to pay for manures very much in his own hand, and he must take care that he does not impose upon

himself a price greater than he can afford. Chemists have always recognised this point, as far as possible; and as far as I am myself concerned, I have always endeavoured to arrive at a fair system of estimating the value of a phosphatic guano; but it must be admitted that there are serious difficulties in doing this, because there is no definite standard of value for such guanos. It is difficult to decide whether we are to make a Bolivian guano at £11, or some other guano, almost identical with it in composition, but selling at, perhaps, £7 or £8, the standard to which other guanos of the same kind are to be referred. Until such questions can be definitively settled, the valuations of these manures must always be attended with uncertainty. What chemists have really wished to do is to warn the farmer against guanos such as that of which the following is an analysis, and which clearly cannot be used with profit.

Water,	7.52
Organic matter and ammoniacal salts,	9.63
Phosphates,	29.12
Carbonate of lime,	52.87
Alkaline salts,	0.31
Sand,	0.55
	100.00
Ammonia,	0.36

Whatever system of valuation we may use, it is clear that samples such as this must be estimated at a very low rate. Yet it is not uncommonly stated that such guanos produce, in particular cases, as good effects as those containing double the quantity of phosphates and ammonia. It is scarcely necessary to remark that the *general* experience does not accord with this view, and I have often observed that those farmers who are most accustomed to experiment, and devote most attention to it, are usually at one with the chemist on these points. There is, however, one matter to which I think too little attention has been paid in making experiments with light manures: Calculation shows that when we use 3 cwt. of guano, or any other manure, to an acre of land, we apply it at the rate of little more than an ounce to every square yard; and it must be admitted that whatever precaution may be used, it is not possible that the distribution of this small quantity can be uniform. The probability is, that an unnecessary accumulation may occur in some spots, while others are left without a sufficiency; and, under such circumstances, it is obvious that the effect produced will be no greater than might have been obtained from a smaller quantity more uniformly distributed. This question might easily be settled by experiment; and it would be most desirable that trials should be made in which the same guano is used alone, and mixed with it once or twice its bulk of dry sand or soil before application, so as to admit of its more uniform distribution.

REPORT BY THE COMMITTEE APPOINTED BY THE HIGHLAND AND AGRICULTURAL SOCIETY ON THE SUBJECT OF THE ENGAGEMENT OF FARM-LABOURERS.

[*Submitted to and approved of by the General Meeting of the Society, held on* 27*th June* 1860.]

YOUR Committee were appointed by the following resolution of the Board of Directors on 3d June 1859:—

"That a Committee be appointed to consider and report as to the various methods in use for procuring the engagement of farm-labourers, male and female, whether it may not be possible to dispense with hiring-markets, from which many evils flow, directly and indirectly, and to suggest any practical method or methods by which such labourers may be engaged, with due regard to their capacity and character."

The Committee then appointed consisted of the following gentlemen:—

Sir JAMES GARDINER BAIRD, Bart.
Sir THOMAS BUCHAN HEPBURN, Bart.
Mr GIBSON, Woolmet.
Mr FORBES IRVINE.
Mr ARBUTHNOT of Mavisbank.
Mr MELVIN, Bonnington.
Mr WARDLAW RAMSAY of Whitehill.
Lord BINNING.
Mr WARRENDER, yr. of Lochend.
Mr MACLACHLAN, of Maclachlan.
Professor BALFOUR.
Mr MAITLAND HERIOT, *Convener.*

At the half-yearly meeting of the Society, held on 29th June thereafter, Sir John Stuart Forbes stated "that he had given notice of a motion on hiring-markets; but the Directors having, some time previous to receiving his notice, appointed a Committee to inquire into the whole subject, he withdrew his motion, two members being added to the Committee at his suggestion, namely, Mr Henry Stephens and Mr Maclagan."

Soon after their appointment, your Committee, as so constituted, adjusted a schedule (as per form annexed, Appendix No. I.), for the purpose of obtaining information and ascertaining the sentiments of a number of influential individuals and of leading agriculturists in all parts of the country.

In answer to this schedule, your Committee have received upwards of two hundred replies containing a large mass of valuable and interesting information.

Taking the information as supplied by these returns, your Committee beg to report to the Directors and the Society that the methods in use for procuring the engagement of farm labourers appear to be the following:—

I. BY PRIVATE HIRING.

This seems a very common method of hiring, and in a few districts of the country almost the only one. By it the *highest* class

of servants (such as foremen and others requiring any particular skill) seem to be engaged throughout the whole country, after due inquiry as to character and qualifications. Some farmers also engage their whole labourers privately, after inquiry as to character and capacity. In some places women are almost all engaged privately.

II. BY PRIVATE HIRING IN COMBINATION WITH HIRING-MARKETS.

Some farmers do all in their power to discourage hiring-markets by engaging servants previous to the date of the market, and making use of *them* only as a last resort.

III. BY ADVERTISEMENT.

This mode is sometimes used, and with good effect, an advertisement in a local newspaper being immediately answered by numerous applications from qualified servants.

IV. BY PRIVATE HIRING, ALONG WITH MONTHLY OR SHORT ENGAGEMENTS.

This method is employed by some parties, and seems to work well. Those who have tried it recommend engagements by the month, and give at least two holidays yearly, avoiding the days of the hiring-markets. It is said that with monthly engagements servants stay longer in their situations than those engaged by the half-year, and that there is no difficulty in procuring servants between terms.

Various parties suggest short or monthly engagements, along with a register in the market town, and attendance by the masters and servants at any of the weekly markets, or at the last weekly market of each month.

V. BY REGISTERS.

These seem to exist in a good many places, but are mostly of recent origin, and not very extensively used. They are very generally recommended for adoption in the Returns, and it has been suggested that if a proper system of registration were devised by the Highland and Agricultural Society, and offices established in every town or district, markets would not be much resorted to, and the change would be beneficial both to masters and servants, as character and ability would then be passports to desirable situations, and both masters and servants would have an opportunity of inquiring about each other. While the Committee report this suggestion—and they have received the same suggestion from many quarters—they think it right, at the same time, to notice, that it does not appear to be founded on any extensive experience of the system, as any registers of which the Committee have got information are only of recent origin.

VI. BY HIRING-MARKETS.

This is the method that is at present most extensively used. There are a few counties where they seem to be unknown, such as Ross-shire, Wigtonshire, &c.; but, with a very few exceptions, they exist everywhere.

At the same time, there appears to be a very general feeling of dissatisfaction with the system, and the opinion is very general that, as at present conducted, they do not work well.

They are stated to produce very considerable drunkenness and immorality, and to work unsatisfactorily for both masters and servants. As to the first of these statements, your Committee have much evidence from almost all quarters: as to the second, it is said that, amid the hurry and bustle and crowd of a market, it is impossible for masters to make any inquiry into previous character, and that the result is, that practically the servants are generally engaged with reference only to their external appearance and strength.

The hiring-markets are very generally said to produce a continued desire for change in the servants, to take away both object and desire for improvement, and to make them careless and reckless as to their conduct and character, as they can with ease get a place without reference to character; and that they tend to put the inferior workman on the same level as the good.

While it seems to be the general opinion that hiring-markets are not in a satisfactory state, there is very considerable difference of opinion as to what should be done with reference to them.

Somewhere about one hundred gentlemen are of opinion that they should be retained—either as necessary evils, or because they see no better system, or because they think them capable of improvement—and a few are satisfied with them as they exist.

Some of the suggested improvements may be noticed. One very common suggestion, and which seems to have been carried out in various localities with good results, is the total abolition of the drinking booths, and providing refreshments on a large scale on temperance principles. Another is, that only men should be engaged at the markets, and the women privately. Another, that they should close early in the afternoon. Another, that they should be retained along with registers. Another very common suggestion is, that farmers should employ married men as much as possible, as is done in Berwickshire and Roxburghshire, and that then some of the great evils connected with the markets would disappear.

Upwards of ninety gentlemen, on the other hand, propose that they should be abolished as soon as possible, and suggest as substitutes some of the modes of hiring previously noticed. Such is shortly an abstract of the Returns received by the Committee.

Your Committee have had repeated meetings, and have had before them the information contained in the Returns; they have also had before them the Report laid before the Directors of the Society in May 1849, signed by Mr Makgill of Kemback as convener. After having carefully considered the whole subject, they have come to the following conclusions:—

1. That, while hiring-markets, as at present conducted, seem to be very generally condemned, any practical measures to be adopted by the Highland and Agricultural Society on the subject of the engagement of farm-labourers must be a gradual work, depending to a large extent on the progress of public opinion.

2. That the practical measures which your Committee have to recommend are accordingly suggested with the view, not of coming at present to any definite or final conclusion on the subject, but of keeping it before the public attention for some time, so that the public may have an opportunity of considering it fully and in all its bearings, and of arriving at mature and sound conclusions.

3. That your Committee have accordingly to recommend to the Directors and to the Society that the prizes (as per Appendix No. II.) be offered by the Society with reference to the subjects there specified.

4. That while your Committee propose in this way to keep the matter under public attention, they would strongly recommend local agricultural societies, farmers' clubs, and individual farmers, to proceed at once to make experiment of the different methods of hiring suggested in the Returns, with the view of ascertaining for themselves, and of giving the Society the advantage of a larger and more extensive experience than they now possess.

5. That while your Committee believe the above conclusions are all that the present information justifies them in arriving at, they think they are also justified in saying, that as the Returns show a very widespread dissatisfaction with hiring-markets, it is incumbent on employers in their several spheres to foster and encourage the growth of mutual respect and regard between them and their servants, and to take a kindly interest in the welfare, prosperity, and happiness of those in their employment; your Committee being assured that in those districts where such feelings largely prevail, the tone of society is higher, changes are less frequent, and hiring-markets are less frequented.

FRED. L. MAITLAND HERIOT,
Convener of Committee.

EDINBURGH, 2*d May* 1860.

APPENDIX.

No. I.—*Queries in reference to Hiring-Markets.*

1*st.* How are farm-servants, male and female, including those for house or dairy work, engaged in your district?

2d. If hiring-markets exist, do they work satisfactorily, or the reverse, in the way of obtaining good servants?

3d. Is attention paid at hiring-markets to the previous character of servants, or are they generally engaged irrespective of character?

4th. Do country tradesmen—such as millers, smiths, wrights, &c.—engage servants at hiring-markets, and do any other parties attend them for a like purpose?

5th. Is it chiefly the younger class of servants who attend these markets, and are they regarded as holidays?

6th. Is earnest-money given when a servant is engaged, and, if so, is there any disadvantage from the practice?

7th. Are hiring-markets productive, directly or indirectly, of evil in your district?

8th. Are you of opinion that hiring-markets are susceptible of improvement, or that they should be abolished?

9th. If susceptible of improvement, what means would you employ?

10th. If they should be abolished, what means would you employ?

11th. If abolished, what substitute would you suggest?

12th. If servants are obtained in your district without hiring-markets, be pleased to specify the means—whether by a register, by certificate of character, or otherwise.

13th. Does your system work well?

14th. Be good enough to furnish any suggestions or information not embraced in the foregoing queries.

No. II.

1. A prize of £25 for an approved report on the best designed, the best managed, and the most useful register for farm-labourers in operation during the years 1861, 1862, and 1863. The report shall specify the books used, the rules and regulations in force, the reference made to character, the names of masters and servants entered respectively as desiring servants or situations, and the number of masters and servants supplied during each of the above years, &c. The reports shall be lodged with the Secretary by 1st March 1864.

2. A prize of £50 for an approved report on the practical steps most successfully carried into operation for the regulation and improvement of any hiring-market held during the years 1861, 1862, and 1863, taking into account the hours of opening and closing; the hours of arrival and departure of railway trains; the arrangements of the market, including the order, and method, and locality of hiring; the nature of the registers in use; the extent to which they are employed; the facilities afforded by them for reference to character; the substitutes for drinking; the providing of temper-

ance refreshments; the getting up and regulation of proper amusements for the people, &c.; the effect of the whole on the sobriety and morality of the people, and on lengthening the duration of service. These reports shall be lodged with the Secretary by 1st March 1864.

ACCOUNT OF THE DUMFRIES SHOW.

By R. Russell, F.R.S.E.

After an interval of fifteen years, the Highland Society has once more had a successful meeting at Dumfries. This, indeed, was not to be wondered at, considering the high position which the district has occupied in the progress of agriculture. From the lapse of time, the meeting was quite a novelty, and truly an event, so far as the rising generation of farmers in the district were concerned. The exertions which the magistrates of Dumfries and the members of the local committee of management cheerfully underwent in carrying out all the necessary arrangements, was a good index of the hearty welcome which the Society met from the gentlemen in town and country.

In writing a report of the Show for the Society, we have to acknowledge our obligations to each and all of the Judges and officials with whom we came in contact. We are only sorry that in the shortness of time and multiplicity of things demanding our attention, we could not draw more largely upon the information which was kindly given to all our inquiries. Mr M'Lagan's able and elaborate report of last year has in a great measure lightened our labours, inasmuch as it may be said to have cleared off all arrears which the want of such reports had allowed to accumulate. In that report we have a short history of the improvements which have recently taken place both in the breeds of animals and manufacture of implements, which does away with any necessity of our going over the same ground. We are quite aware that there exist differences of opinion on many of the points upon which it is our province to touch. No one would be disposed to offer his opinions with more deference to those of others, and any that may be put forth on our part must be taken rather as suggestive than critical in their spirit.

The ground chosen for the Show was in all respects suitable, though some pedestrians might consider it too far from the station, in a town where cabs and other conveyances are not too plentiful. About fifteen acres on the farm of Lincluden Mains were fenced off to the north of the Castle Douglas Railway. A large siding was formed along the line, at which stock and implements could be most conveniently taken directly from the trucks and put

into the yard. The soil was light and porous, and formed the best possible footing during some of the damp and rainy days. The heaviest class of implements, such as steam-engines and thrashing-machines, were very properly ranged close to the siding. These, with the other implements running in rows north and south, occupied the southern part of the grounds. The roofed shedding for stock, on the other hand, ran in parallel lines along the northern part. A broad road, or vacant space, the highest part of the grounds, led from the siding to the Committee Rooms, and where a good idea could be formed of the extent of the exhibition. Here, also, a fine prospect was presented of the richly-cultivated slopes of the Tinwald, Galloway, and Annan Water high grounds, enclosing a wide circle of slightly undulating plain, in which the "Queen of the South" is finely situated.

Friday and Saturday, the 27th and 28th July, were busily devoted to placing the implements in the several sections. Things were in a sufficiently forward state to admit of the Judges commencing their labours on Monday morning. Throughout Monday the weather was most propitious, and a great amount of work was comfortably gone through.

At an early hour on Tuesday morning the judges of implements again resumed their labours. About mid-day, the ploughs, harrows, and grubbers, which were deemed most worthy of a trial, were in order for commencing at Lincluden Mains. The public were admitted to the trial ground on a payment of 6d. each; and 1200 persons inspected the proceedings during the afternoon. A slight but passing shower fell about two o'clock, but it did not damp the eager interest with which the trials were watched. The trial of the thrashing-machines and other implements were at the same time conducted in the yard. In the evening Dr Anderson gave a lecture on manures in the court-room, which was well filled by an attentive audience. At its conclusion a discussion took place on some of the highly important points that had been touched upon.

On Wednesday morning the trial of ploughs was continued at Lincluden Mains, and the judges of thrashing-machines only then completed their awards. The live stock were dropping in on Monday, and the most had found their places by Tuesday night. By seven o'clock on Wednesday the whole were placed, and the judges then commenced their labours. The awards were completed before one o'clock, which enabled the directors to admit the public to the yard an hour before the time announced in the programme. It is supposed that nearly 3500 individuals were in the yard during the afternoon. The weather, cold and cloudy throughout the morning, gradually became more threatening as the day advanced, and, as a fit specimen of this rainy sunless summer, ended by a thoroughly wet evening. The pleasure of the day, though thus greatly marred, was agreeably wound up by a particularly happy

party at the Banquet. A company of 370 dined in the goods shed of the South Western Railway. They found themselves seated at two rows of tables in a long and narrow building, which had more resemblance to a large tunnel than a dining hall. At first sight it had altogether an odd appearance, as no one could recognise the features of a friend from one end of the building to the other, though his voice, it was found, might be transmitted almost unbroken to the ear. The acoustic properties of the building, indeed, surprised as well as delighted every one.

Thursday, fortunately, turned out fine as to weather. The gates were opened at seven o'clock, and the price of admission was 1s. to the public. About 16,000 persons visited the Show during the day, and at times it was densely filled. At first the crowd flowed on along the ranges of cattle-sheds, and afterwards took a passing glance at the implements. The extra and general collection of implements had its own share of attention. When Shows are every day becoming more and more a holiday to the population, the miscellaneous articles will, no doubt, add greatly to their interest among a certain class.

On Friday the weather was again fine, and the prize cattle were shown to advantage. The total receipts of money at the gates during the four days' trial and exhibition, was £1086, 10s. 6d. The total amount drawn at Dumfries, in 1845, was £426, 11s. 6d. In making any comparison, however, between these results, it should be observed that members of the Society are now freed from payment, and that farm-servants are admitted at half price.

One who had seen both this and the Show at Dumfries in 1845 would have been better fitted to have made a true comparison between the characters of the stock and implements at both. Mere figures, we are perfectly aware, can only impart imperfect ideas on the subject. The following, however, show the number of animals, dairy produce, and implements in both years:—

	Cattle	Horses	Sheep	Swine	Poultry	Total	Dairy Produce	Implements	Premiums
1845, . .	297	75	537	62	101	1072	88	143	900
1860, . .	298	166	558	54	216	1292	195	911	1500

GALLOWAY CATTLE.

This district could alone bring together so fine and so large a collection of Galloway cattle as were seen on the ground. The changing of the place of exhibition is, as in this instance, fraught with many advantages to the student and fanciers of cattle. A few of the best specimens, no doubt, find their way to more distant places of exhibition, but we can better judge of the character and leading features of a breed of animals, as well of the general march of im-

provement, by seeing a sufficient number of animals from the best breeders brought together. The resemblance which some of the finest specimens of the Galloways have to the more kindly and better pointed Angus was interesting. This was such as to give increased probability to the opinion, which we have heard some good judges maintain, that the one animal is but the effect of better treatment and culture over the other.

There were very few inferior specimens among the eighty entries for Galloway stock, which speaks volumes as to the care bestowed on their rearing. We were not singular, however, in regretting that an additional section, or even two, had not been left open for fat cattle of this established breed. One wishes to see the results of so much breeding and selecting, in the shape of the finished or fattened animal. The capabilities of a breed would be made more apparent, and more exact data might be got and registered as to progress in weight and ripeness at a given age. Something of this sort could be done, perhaps, with respect to the particular breeds of a district, without making these exhibitions mere displays of fat stock. The capabilities of the breed in this respect were but imperfectly represented by the fat specimens found among the extra-polled Galloways.

POLLED ANGUS OR ABERDEEN.

As was naturally to be expected, there were comparatively few entries of polled Angus or Aberdeen. The most celebrated breeders of all these highly finished animals brought select specimens of their stock, and rendered all the sections remarkable as containing first-class animals. Mr Bowie's three-year old bull, and Mr M'Combie's two-year old, could scarcely be excelled. The three one-year old heifers shown by the trustees of the late Robert Scott, were remarkable animals to be found in one herd. The four aged cows of Mr M'Combie had new honours heaped upon them, and gave some idea of the success which has crowned persevering efforts. The absence of inferior specimens from this breed put one in mind of a good picture without any background as a relief to so great excellences. District exhibitions alone show the gradations of merit in such breeds, and enable us to form a more distinct estimate of the characteristics of the class.

SHORTHORN.

The shorthorn being comparatively cosmopolitan in its character—for it thrives wherever a sweet and sheltered spot of ground can be found from one end of the island to the other—is always the most attractive feature among the live-stock at the national shows. Many circumstances tended to give increased interest to the competition in this class. Prime stock were brought together which had been bred in very distant localities, for some of which large prices

had been paid. And, as usual, the decision of the judges gave occasion for the expression of a great contrariety of opinions respecting the comparative prominence which certain points in regard to style and symmetry should have the one over the other. This is just as it should be; and it is only to be regretted that the grounds upon which the awards are made are not given, so that the public might know what qualities are most in vogue, and what are the present standards of taste and fashion. It would be most difficult, no doubt, to make up a scale of a certain number of points which might be deemed perfection in an animal. How far such a method of giving expression to the shapes and figures of prize animals is practicable, can only be solved by breeders themselves. Those who are favourable to such a system, point to its successful operation in the island of Jersey. This would form a capital subject for discussion at one of the monthly meetings of the Society—Mr Douglas, or some equally eminent breeder, would confer a great benefit on the agricultural interest were he to handle such a topic.

The show of shorthorns was deficient in good bulls—indeed, there was not one really good specimen in the lot—young or old. It is rather strange it should be so, but nevertheless this seems to be only a characteristic of other shows, whether district or national. This may so far be attributable to the circumstance that parties using herd bulls find that they do not work well when in too high condition, which still, perhaps, influences too much the decisions of Judges. In the *class of aged bulls*, the prize animals were only of middling merit, and four or five others were almost equally good. Without doubt, the *two-year-old bulls* were the best selection. Lord Kinnaird's is a good and useful animal; his strong shoulder points were his chief faults. *The one-year-old bulls* were very moderate. Among the *cow class* there were some good specimens. Mr Douglas's three-year old is a very superior animal for her age—so level throughout, and quality everything that could be desired. The second-prize cow seemed to be somewhat overdone. Too much forcing appears to have rendered her patchy, and to have so far spoiled the harmony and symmetry of the several parts: a wonderful constitution, however, was a strongly redeeming feature. *The two-year-old heifers* formed a capital section; Mr Douglas's "Clarionet," massive and symmetrical, carrying a large amount of lean flesh, with an extraordinary girth. Either of the twin "Duchesses," the celebrities of Canterbury, made good seconds, and attracted a vast deal of attention. We only wish we had space to indicate a few of the leading opinions entertained by several of the shorthorn breeders in their partiality for each of the worthy rivals. Though fully ripe, the "Duchesses" were by some considered plain, if not faulty, in their hind-quarters. Mr Atherton showed a very creditable animal; we heard she has

since been sold for 200 guineas. The *yearling-heifer* section was largely made up of first-class animals. The two first-prize animals have perhaps never been excelled at any Show of the Society, their merits being very evenly balanced. Besides these, there were four or five animals of a superior caste, which it must have been no easy task to place. *In the extra shorthorns*, Mr Douglas had it all his own way. His three animals were welcome guests in the way of gracing the Dumfries meeting. Two of the animals are no strangers to the breeders of shorthorns. The "Rose of Athelstane," as is well known, won three national first prizes in 1857; "Rose of Sharon" the first prize at the Irish National and and at the Highland Society last year. The "Maid of Athelstane," too, is of as good a cut and figure as her eminent exhibitor had in the yard.

AYRSHIRE.

Unlike anything prevailing in the northern counties of Scotland, dairy husbandry forms a prominent feature in the management of large arable farms on the five-course shift in Dumfries, and in some other of the southern counties. Large numbers of cows are kept on the farm and let out to a second party at so much a-head; and thus a subdivision of the labour of details is effected. The dairy and the feeding of sheep on many farms go hand in hand. As the Ayrshire breed of cows is found most profitable at the pail, a good show of this breed was to be expected. The entries were numerous; and if the Society can boast of a better general selection of animals of this breed at some of its former meetings, the prize-takers were all first-class animals. One feature worthy of notice is, that the great majority of the entries were from the localities more specially embraced within the district. Some parties were even excusing the fewness of the numbers. It was suggested that more would have been on the ground had the time of entry been somewhat extended. It is worthy of note, too, that many of those early calved were said to be kept at home, owing to the vessel not showing well beside the late calved ones. This point, like condition in a shorthorn, is certainly too much looked at now by judges. We lately heard of a breeder of Ayrshire cows having all his cows calving in autumn, that they may appear to the best advantage at the shows at that season. A scale of points of perfection would undoubtedly serve a good purpose in this instance, by assisting to prevent an undue value being attached to any one point.

HIGHLAND.

The fewness of entries in this class was to be expected from the distance of the Show from the highland valleys. Some of those that were shown were splendid animals. Mr Pollock's three-year-old bull was a well bred animal, fair head and legs, but, if anything, deficient along the back. The premium *cow of any age* was

almost complete in every part; her fine light dun hair flowed characteristically over a brow, with fine muzzle; the horns were unexceptionable, and the back faultless. This will be a showy animal in October when the winter coat is on. Mr Pollock's were well bred and useful animals, as also his three-year-old heifer (261), excellent in most points except the head, where the hair is slightly inclined to curl instead of flowing, and the muzzle is not so elegant. The two-year olds (263 and 264), belonging to the same individual, were sweet and almost perfect animals. There was also one splendid specimen of the breed in the extra cattle, shown by the Misses Baird of Closeburn. The symmetry was excellent, and the light fancy dun colour, adding greatly to its beauty, set it off to advantage.

FAT OXEN—CROSSES AND POLLED.

The three year-old crosses were all wonderfully good animals. The two-year olds were not so ripe and so attractive. Among the extra cattle, Mr Osburn's cross ox was almost as fine a handler as could be desired. Among the EXTRA CATTLE, the small Brittany bull and cows shown by Mr Prentice, Edinburgh, were great objects of curiosity.

HORSES.

The show of horses, as a whole, was inferior as to quality. In *aged stallions, and three-year-old entire colts* especially, the turnout was exceedingly middling. Some well knit and symmetrical frames were commonly marred by a roundness and want of cleanness about the joints. Mr Buchanan's two-year-old colt was much admired. It was a strong and handsome animal, and might have had a better place on the prize list but for a slight twist on the hind legs, indicating a weakness below the hock, which may wear off as it gets older. The eight-year-old mare of Mr Rigg was truly a beautiful animal, of a rich dappled bay, and of a cut and figure that are rarely met with. We believe a portrait of this animal is to be taken by an eminent artist, to adorn the rooms of the Society's Museum in Edinburgh. One of her progeny, a three-year-old filly, stood beside her, easily first in her section, displaying symmetry, and the characteristics of bottom, power, and good temper. For general excellence, the *two-year-old fillies*, section 8, outstripped all the others. The premium animal was much admired, and few or none were disposed to question her title to her placing even where there were so many good specimens.

The Judges commended a black hunting-horse of great power, among the EXTRA entries. The six Iceland ponies shown by Miss Hope Johnstone, Stidriggs, Moffat, afforded some idea of the development of the horse genus on the borders of the Polar circle. Wanting in the fine symmetry of our Shetlanders, they exhibited

so remarkable a uniformity of type and character, that at a cursory glance it was difficult to find one better or worse than another in the lot.

CHEVIOT SHEEP.

Out of deference, we suppose, for what the district has done for the breed, the Cheviots have been placed first in the sheep class. The show of this breed as to number and quality has never been excelled at any former meeting of this Society. The entries were numerous in all the sections, and the premiums were closely contested in each. The names of many of the most celebrated breeders figure in the premium list. This breed has been long and carefully cultivated. Perhaps the points of excellence are even better understood and more consistently sought after than has been the case among the Leicesters. Inferior to the heath sheep in hardiness for the most stormy regions, or for the poorest pastures of the Highlands, they have nevertheless proved a valuable animal on many of our high and bleak pastures, and for obtaining crosses with the Leicesters where turnips are largely grown. The general character of the animals exhibited robustness of constitution, combined with symmetry and a fine description of wool. We cannot refrain from stating that we should have liked to have had a section or two of fat wedders of this class, to see what the farmers of the district can really make of them before sending them to market. This district, too, excelling all others in the rearing of half-bred sheep (crosses between Leicesters and Cheviots), might with advantage have shown the capabilities of such stock. Had such a section been open, opportunities might have been afforded for more fully understanding the merits of the smaller and larger breeds of Leicesters for crossing.

BLACKFACED SHEEP.

The show of blackfaced sheep has been better both as to numbers and general excellence at some of the former meetings. It was, however, an interesting selection of the various types of this breed. Its more hardy and economical character over some of the other races which have been gradually displacing it in its native mountains, has been amply demonstrated in the severe ordeal to which hill-stock was subjected last winter. Many of these animals gather sustenance on the very verge of the vegetable world, and no wonder that it requires much skill and care to maintain stock up to the more modern standards of excellence. In many situations the wool becomes thin and hairy, and the carcass loses its shape, if the breed is not regularly resuscitated by an admixture of blood from more favoured localities. Among the *aged tups* the well-marked peculiarities in the type and figure of the animals belonging to the different breeders were worthy of attentive study. The first and second prize animals were remark-

ably fine specimens, and quite redeemed this section from mediocrity. The first premium tup (547) of four-shear was quite a model of its class. A large and beautifully square carcass, in which the shoulder was completely hid, with broad chest and wide-set legs, of rather small bone, made it bear a look from any position. The head was finely set on, with horns neither too heavy nor too light, and symmetrically turned to a wish. A lot of fine and thick wool, having all the characteristics of long staple, came down to the knee and hock-joints, and gave the animal an elegant appearance. A slight thinness over the withers, which was only apparent on handling, was the chief defect. This peculiar and distinct type seemed to be aimed at in all the sheep throughout the different sections shown by the Messrs Murray. It scarcely required a catalogue to let us know the race throughout the other sections. The younger animals did not show quite so well, having a general tendency to a narrowness of chest. Mr Brydon's two-shear tup having a deep and full-ribbed carcass, first-class wool, and exhibiting all the characteristics of strong constitution, was much admired even beside its more graceful rival. Mr Archibald's tups were rather in too low condition to show well. The finely-finished hindquarters were their best points. There were no remarkable animals among the *Dinmonts or shearling tups.* Mr Pollock's three-shear ewes were much admired along with the excellent lambs at foot, which kept them in low enough condition to show to the same advantage as those in the neighbouring pens. Perhaps both Highland cows and blackfaced ewes should always be shown with their progeny suckling, as the practice of weaning early serves to hide faulty points. *The shearling ewes or gimmers* were capital—not an inferior lot among them. The blackfaced sheep, as a whole, exhibited pretty clearly that the prevailing fashion among breeders is neither to have the face too white nor too dark, but rather of an intermediate mottle.

LEICESTER.

The animals in this class were a good lot throughout, quite equal to any which has ever been on the ground at any former meeting of the Society. Mr Beattie's were capital specimens of the Scotch Leicesters, being of good size, well formed, and having fine quality of mutton, and also a fine fleece. Indeed, the whole of the prize animals were highly creditable to their respective exhibitors.

LONG-WOOLLED OTHER THAN LEICESTER.

The gradually increasing number of entries of long-woolled sheep other than Leicester is but another indication of the tendency of Scotch breeders to obtain size. The entries in this section consisted almost entirely of Cotswolds; and very excellent they were. The list of exhibitors show that this massive and useful sheep is in the

hands of those who will see that all justice is done to it out of its native region. Whether it may succeed as well under liberal treatment on the best class of our hilly turnip soils as on the exposed Cotswolds, is now under trial. For crossing bred and half-bred ewes, the Cotswold will give hoggs of a large size, and heavier fleece will be got, while they will come as early to maturity. The more compact description of these sheep should be used, as it is not such a violent cross as with a sheep of long frame, and very likely long neck. Lord Kinnaird's and Mr Scot Skirving's were good specimens.

SOUTHDOWN.

The southdowns were not numerous. The Duke of Richmond sent us good specimens of his well bred animals, seemingly too delicate for our Scotch grazing grounds. Mr Scot Skirving's sheep exhibited more strength and substance, and appeared as if they were rapidly acclimating under his management. They were not in high condition, but looked and handled remarkably well.

EXTRA SHEEP.

Instead of the aged sheep which were usually entered in this class, we should most certainly have preferred a section or two of fat sheep, crosses and pure bred, showing the age and quality of the stock within the district, such as may be regarded as the result of all the careful selecting and breeding of Leicester, Cheviot, and blackfaced. As it was, however, this formed an interesting enough group. Mr Biggar's alpacas, too, had their own share of attention from the visitors.

SWINE.

More attention is paid to the rearing and feeding of pigs in the Dumfries district than in any other part of Scotland. The refuse of the dairy affords a certain amount of food for this description of stock. Considerable breadths of potatoes, too, are often consumed along with meal of various kinds in fattening. Parties from a distance were rather disappointed at the small number of entries in this important class. What was still more singular, the majority of exhibitors were from a distance. At the local exhibitions the pigs in the district are said to be much better brought out. This is perhaps to be attributed to the existence of a large but distinct breed of swine in the county, which, though highly esteemed at home, does not compare so well in many points with the English large breeds. The pens, therefore, might have been better filled had an additional section been left for swine of the Dumfries breed. As it was, however, a fair share of the prizes came to a local exhibitor, Miss Bell, Woodhouselees, Canobie. The *small breed* is not in much repute in the Dumfries district. In this section the competition was close among very select animals. The premium sow was generally

considered to be an almost perfect animal. The *pigs not exceeding eight months old* were inferior.

POULTRY.

The show of poultry was very generally considered to be anything but superior in quality. The season of the year is not favourable, as the plumage is deficient. The district, though as rich in geese and hens as in pigs and cows, did not put forth its strength in the way of numbers of poultry. The local exhibitors, however, Miss Bell and Mr Barker, carried off some premiums, where the most famous breeders of poultry in the north were competing. Nine kinds of hens, three of ducks, and as many of turkeys and geese, gave considerable variety to this class of live stock.

DAIRY PRODUCE.

Perhaps the Society has never had a better display of butter and cheese at any of its meetings. Since the time that the Show was last held in Dumfries, in no department of farm management has there been greater progress within the county than in the making of butter and cheese. There were few or no inferior specimens to be found within the large and well-filled erection. Formerly the district was noted for its inferior dairy produce. Indeed, among the merchants in Glasgow and Edinburgh, any cheese of inferior quality was said to have had the "Sanquhar flavour." This year's exhibition has amply wiped away all reproach in this respect, thanks to agricultural exhibitions for the high standard of excellence set before every one.

IMPLEMENTS.

Ploughs.—Twenty-four entries of *ploughs for general purposes* rendered the selection of those for trial no easy matter. They were generally substantial and well finished, without any needless amount of extra work in the way of polish; no new methods of fitting and adjusting the various parts were seen. There were fewer wheel-ploughs on the ground than at the Edinburgh Show, and the nature of the trial-field at Dumfries was not calculated to exhibit the strong points or the merits of the two forms. At Myreside, a substantial loam in a very dry state, full of small angular trap-stones, tossed about the swing-ploughs, and rendered their work far from being good. On the other hand, the wheels had the effect of keeping the ploughs steady to their task, and under the circumstances made admirable work. At Lincluden, the hay stubble was a loose sandy soil, scarcely entitled to the name of loam, having some small pebbles through it. Though the land was dry, swing and wheel ploughs were both working sweetly, so that the wheels might to many seem merely useless appendages. High and low crest-ploughs were at the trial, and exhibited the

two kinds of ploughing which at present divide the tastes of farmers. The merits of the two kinds of work have been so often and so fully discussed, that we need not enter upon them in this place. Each has its advocates and followers, and both should receive encouragement at our shows. If a high-crested furrow is required, let competitors know whether it is to be obtained by putting the coulter to the land side and cutting out the bottom, or turning up the feather of the share and leaving an irregular floor below. Why not have a separate section also for rectangular cutting ploughs? Exhibitors should know what is actually wanted. We have no doubt that many of our leading implement-makers would cut the furrow and crest it in any way desired, if they only knew what were the points to be aimed at. The absence of a consistent and distinct specification of these points for the guidance of exhibitors, has naturally enough led to capricious decisions. By having an additional section, or two at most, improvements would in all probability have a more smooth and rapid progress. That something of this sort is needed, may be amusingly illustrated by an incident which occurred on the trial field. In utter disregard of all our northern notions of the state in which the surface of a ploughed field should be left, Mr Page of Bedford was working with his skim-coulter! True to the main requirements of the four-course shift in ploughing clover stubble for drilling wheat, this eminent agricultural machinist was inquiring if the chief point in arriving at a decision was in having the grass and stubble well buried? This was, no doubt, thoroughly accomplished, but the action of the skim-coulter was altogether fatal to anything in the shape of a crest, inasmuch as the foundation upon which it could rest was cut away. The furrow was broken and loose at the top, and though well laid over, felt, to the foot, as if it was deficient in packing. In a furrow six inches in depth by nine in breadth, the following were the amount of the draught of the ploughs, by the dynamometer applied by Mr Slight:—

2. Barrowman,	$3\frac{1}{2}$	up ascent,	$3\frac{1}{4}$	down.
4. Burns,	3	„	$2\frac{3}{4}$	„
6. Dobie,	$3\frac{1}{4}$	„	$3\frac{1}{4}$	„
7. Gray,	$3\frac{1}{4}$	„	3	„
10. Halliday,	$3\frac{1}{4}$	„	3	„
12. Hope,	4	„	$3\frac{3}{4}$	„
17. Law,	$3\frac{1}{2}$	„	$3\frac{1}{8}$	„
20. Page,	$3\frac{1}{4}$	„	$3\frac{1}{8}$	„
23. Porteous,	3	„	3	„
26. Smith,	3	„	3	„

The *Trench Ploughs* showed a draught from 6 to $7\frac{1}{2}$ cwt. at 12 inches in depth and 15 in width. Page's was working rather beyond its capabilities at this depth. The subsoil ploughs for two or more horses have mostly assumed the grubber form. Law's larger implement retained alone the form of Smith's subsoiler, with the addition of a wheel.

There was a good display of well-finished *Double Mould-board Ploughs.* At the present time there also exists two distinct fashions in the formation of the mould-boards of these ploughs. The majority of those exhibited at Dumfries were of that description which have been more recently introduced. The lower part of the mould-board is cut away below and behind to a greater or less extent, which simply has the effect of displacing less earth from the bottom of the furrow. What is displaced, however, is thrown up into a sharper apex by the tail of the mould-board. A neatly-finished drill is the result. The old concave Scotch mould-board made a ridge of the same character, and was also easily drawn. The other form of mould-board takes more earth out from below without throwing it much up, and requires more power than the other. We need not enlarge upon the respective merits or defects of the two forms; it is sufficient for us to state, since both have their advocates, that the two are not strictly comparable, and were they thrown into two sections, there would be less risk of decisions being made capriciously.

GRUBBERS OR CULTIVATORS.

There were 14 entries of *Two-horse Grubbers or Cultivators.* The prevailing make was that invented, we believe, by the late Wilkie of Uddingston. The frame in which the teeth are set is suspended from the body of the grubber by slings, which, however well suited for the lighter description of turnip soils, are too weak for heavy lands. For very foul land too, advantage is not got of the high wheels, as the frame does not lift higher than the axle.

NORWEGIAN HARROWS.

There were 6 entries of this implement. The chief difference in their construction was, that in some the cutters are all fixed on a square axle, when in others they revolve separately on a round axle. The former method is said to be preferable, as it gives a greater cutting power. The Judges requested us to state that they consider the Norwegian harrows make a section sufficiently distinct for themselves, and that Crosskill's serrated clod-crusher and roller appeared out of place among them.

CONSOLIDATING LAND ROLLER.

The smooth, ribbed, and serrated forms were on the ground. Mr Robinson of Lincolnshire exhibited a serrated variety, which was commended, having some novelties in its construction, which appeared to meet several of the defects in these kinds of implements. It was all the more unfortunate that it was sadly damaged in taking it out of the truck. Owing to the particular formation of the bushes, the discs maintain an upright position, and being held steady on the axle, do not wear or gall sideways.

HARROWS.

Among the numerous entries for harrows the Scotch square form had scarcely a representative,—the diagonal prevailed. Ashby's rotating harrows, though still imperfect in some points, attracted considerable attention, and the Judges wisely commended them. The *Heavy Land Harrows* were generally characterised by good workmanship. There were no less than 20 entries of *Light Land Harrows*, and among them were several chain harrows, whose makers apparently were at a loss to know whether they should be entered in this section or in that of *Harrows for covering grass seeds*, for they found their way into both. The *Chain* harrows were sufficiently numerous to have formed a section by themselves, and the better classification would have rendered the labours of the Judges both more easy and satisfactory. A general survey of the light land harrows impressed us with the idea that an important principle in their construction is not kept in view by the makers. Those on the ground, as a whole, were too short, necessitating a too close setting of the tines. A light land harrow ought to be fully wider in the tines than a heavy land one, to allow it to work and clear itself of weeds. Burnie's new form of light land harrow was a novelty in its way, and its maker had evidently in view the remedying of a defect which applies, to a greater or less extent, to all iron harrows for the lightest descriptions of land. Iron harrows work too heavy and dead on very light land, and the wooden body is therefore much better adapted for this purpose. Burnie divides the harrow across, and connects the fore and hind parts by means of rings, which will undoubtedly assist in improving the working of the implement on light soils. Its capabilities, however, can only be correctly known by repeated trials in the everyday work of a farm. Harrows for covering grass seeds become too diminutive when made of iron — though the closeness of the common tines is not so objectionable as in the light land harrow. A greater breadth, however, can be covered, for the same power expended in draught, by making grass seed harrows of wooden frames.

GRAIN AND OTHER SEED-SOWING MACHINES.

There were no improvements worthy of note either in *Broadcast-sowing Machines for Grain or Grass Seeds*. In *Drill-sowing Machines* also, there is nothing specially interesting to report, for the Scotch makers seem to be standing still, so far as regards the perfecting of these implements. The greater number of those on the ground, however, had the fore-steerage attached, which has increased the neatness and precision of their working. It would be a great improvement, in more respects than one, to have the two outside coulters placed exactly half the width of the rows from the centres of the wheels. This would allow the outside wheel

to be driven back on its former track, and better enable the workman guiding the machine to notice any deviations from the straight line, and to approach to that ruler-like degree of accuracy which is so pleasing to the eye, and permits of the horse-hoe being used with freedom. The separate sections for *Carrot, Mangold, and Turnip Sowing Machines,* contained many exceedingly useful articles. In a few cases, neat and simple adjusting apparatus was to be seen for altering the quantities of seed sown. Young's turnip and mangold sowing machine is a very efficient implement. By substituting a few plates, these seeds can either be sown in a continuous stream, or dibbled at intervals of any required distance. One implement is made to sow, and to sow well, more than one kind of seed. This is a point that certainly ought to be kept in view in offering premiums for directing the inventive faculties of machinists. It would be much more economical, for example, to have a machine which could sow carrots, turnips, and mangold, than to have one for each—one to sow grain as well as grass seeds broadcast; most of the grain and grass seed machines on the ground, indeed, professed to do this. So, also, it shows a very imperfect adaptation of the parts of a drill-sowing machine, that it cannot sow both beans and other grains at all distances. Were the Scotch makers to take a leaf from the English, and to improve some of the parts of their drills, a cheaper and as good a drill might be produced than any we can yet boast of. At the same time, the complicated appearance of the English drills are more apparent than real, for they often work for years without getting out of order, or requiring the least repairs. The English machines, indeed, are finding their way much more largely into Scotland than we would be apt to suppose, from their absence at the national show of implements.

GUANO PULVERISERS.

To those who are in the habit of using large quantities of guano, the implements which the premiums have called forth have been welcome guests. A great improvement was apparent this year in the general run of the machines which were entered in this section. Light and handy little grinders have been more aimed at, and agriculturists have now the means of performing efficiently what was formerly a tedious and disagreeable piece of work, which was, after all, never rightly done.

HORSE-HOES FOR GRAIN.

There were only three entries for horse-hoes for grain. Hunter of Samuelston's lighter make of the Saxmundham form, seemed a useful article. A lighter and cheaper machine than any which was exhibited, still leaves great room for improvement in this section.

HORSE-HOES FOR GREEN CROPS.

A first-rate display of hoes for drilled green crops. There were twenty-two entries, and scarcely an inferior specimen. The expanding form is evidently not so much in fashion here. The tines, or teeth, move on ribs from the body or beam of the implement, and this has the advantage of always keeping the cutting points parallel to the line of draught. The tines were moderately long, and well *raked* with good broad cutting points, forming substantial and efficient implements.

REAPING-MACHINES.

Being unable to attend the trial of Reapers at Tinwald Downs, we are indebted to Mr Alex. Slight, Leith Walk, for the following report :—

" Several machines, both in section 35, with self-delivery, and in section 36, for manual delivery, were exhibited in the show-yard on the 1st, 2d, and 3d August, but there being no grain ready to try these at that time, it was arranged that the trial should take place on a future day, and the machines entered and exhibited should then have an opportunity of competing for the premiums.

" The 31st August having been duly announced as the day of trial, seven machines were brought to the trial field at Tinwald Downs. One of these, however, competed on both sections—viz. Cranston's (invented and made by W. A. Wood, Hoosick Falls, New York)—as it was altered from self-delivery to manual, by the removal of the self-acting apparatus, and substituting a fixed board with a seat for the deliverer.

" Two other machines were also in the field, but not in competition. The first, Brigham & Bickerton's self-delivery machine, was entered, but was not brought forward at the show, and therefore disqualified. The other, by Alex. Jack & Son, was not entered. It differed from their machine in competition only in having a tilting-board instead of the fixed board for delivery.

" The grain on which the machines were tried was a strong crop of oats, the field level, and well suited for the working of such machines. The grain had a considerable lean in a north-easterly direction, but patches over the whole field were lodged in the contrary direction, and these were cut out with the scythe. On account of these lodged portions, it was resolved to try all the machines on one portion of the field, rather than give a portion to each, as some would have had more lodged grain than others.

" Cranston's machine, with self-delivery, was the first tried. It is fitted with a board somewhat similar to the hand-delivery machine, but having an endless chain moving round it over guide-pulleys at the corners and below the surface. This chain carries one end of a bar of wood about 6 inches deep, while the other end slides through an eye loosely attached to the frame a short distance be-

hind the board at one corner. In working, the end of the bar attached to the chain moves forward in a straight line along that side of the board next the standing grain, across the front, carrying the cut grain with it, then back along the opposite side, laying the grain off in a sheaf at each revolution. This arrangement is very ingenious, but in the heavy crop of oats did not work well, both the raking-board and cutters choking frequently. The reel in front also appeared to go too fast, causing a good deal of grain to be shaken.

"Lord Kinnaird's machine, with self-delivery, by Alexander Shanks & Son, Arbroath, was the next tried. Its performance was highly satisfactory, the grain being well laid in a swathe, from which it was easily gathered into sheaves.

"The first prize in Section 35 was therefore awarded to Alexander Shanks & Son, no second prize being awarded.

"In the machines with manual delivery, Gardner & Lindsay's was first tried, and it made very good work, the grain being well laid off in sheaves—the machine cutting a width of about 4½ feet.

"The next, by Alexander Jack & Son, was similar in construction to the preceding, and cut about the same width, but the delivery was not quite so well managed, and this probably caused a little more short straw or chaff to be found in the sheaf, from the straw lying on the cutters, and being cut a second time.

"Both of these machines being drawn by two horses abreast, with swingle-trees, the dynamometer was applied, and the draught found to be in the former 3½ to 4 cwt., and in the latter 3 to 3½ cwt. In the other machines, the horses being yoked with a pole or shafts, the dynamometer could not be applied.

"Trotter's machine was next tried, and made good work, cutting from 3½ to 4 feet wide. It was first worked with two horses, one in the shafts and the other before; but it was afterwards worked by one horse, and did not seem too heavy for it.

"In this machine the delivery-board and cutter-frame are jointed to the main carriage frame, and supported outside by a small wheel, allowing the cutter to rise or fall to the inequalities of the ground without the risk of straining any part of the machine. Another advantage in this jointed frame is, that in moving the machine from one place to another, it can be folded up against the body, and the whole is then little wider than a common cart.

"Brigham & Bickerton's machine, which was exhibited in the show-yard as a mower, was next brought forward. A delivery-board and seat had been added to it in a temporary fashion, but in such a way that the raker could not sit on it and perform his duties. A little work was made with it by a man standing on it, but in a very unsatisfactory manner.

"Cranston's machine was again put to work, having been altered from self to manual delivery, the reel being at first retained. The

deliverer on this machine was seated at the back of the board instead of at the side as in the others, and used a light three-pronged fork instead of the rake, gathering the cut grain from left to right, and throwing it off in sheaves to the right-hand side. Some of the sheaves were well laid, but the greater part of them were twisted and irregular. When the reel was removed the delivery was rather better, but still imperfect.

"The Judges had a farther trial of Gardner & Lindsay's and Jack & Son's machines, when the first premium was awarded to the former, and the second to the latter.

"Brigham & Bickerton's self-delivery machine, not in competition, was then tried, but did not work satisfactorily.

"The machines then cut a few rounds to allow visitors to the trial field a better opportunity of witnessing their performance, while the Judges examined the stubble-rakes. Only three of these were brought to the field—viz., Caldow & M'Kinnel's, made by Howard; J. Kirkwood's, Tranent; and J. Harkness's, Gretna.

"The first prize in this section was awarded to J. Kirkwood, and the second to Caldow & M'Kinnel."

We have only further to state that, in a communication from Mr Patterson of Offers, one of the Judges, he refers to the great advantage which the division of reapers into two sections, self and manual delivery, had in the making of awards. Such a division was felt to be much required last year. The two classes of machines are not strictly comparable, and the tastes of Judges, when such a separation is not made, are not apt to be unduly swayed by their own local experience or necessities.

HORSE STUBBLE FOR HAY-RAKES.

There were a great deal fewer entries of rakes than at Edinburgh. The whole, however, were first-class articles. The uniformity in style and form shows the effect which such exhibitions have had in raising the general excellence within a very limited period. Both Kirkwood and Page are aiming at improving the action of the teeth by swinging them a little above the ground, instead of resting them on it by slightly bending them near the points. Kirkwood's was characterised by strength, good workmanship, and nicely adjusted parts.

THRASHING-MACHINES.

The thrashing-machines were subjected to a most careful trial. On the whole, they were not making anything like good work in the mere thrashing and separating of the grain from the straw. Many, too, were breaking the grain considerably. Indeed, the merits of the various machines, whether horse or steam power, were decided on this particular point. Had several of the machines at

the trial exhibited anything like an equality in this first and essential prócess—thrashing and shaking the grain—it would have been necessary as well as interesting to have known the amount of power expended in thrashing a given quantity of grain. This, however, was far from being the case, and, under the circumstance, it was therefore worse than useless to make the expenditure of power an element in the question. The mere saving of a few pounds of coals is never for a moment to be put in the balance against bad thrashing. The thrashing capabilities of the machines were tested both by wheat and oats. The latter kind of grain affords a much more rigid test than the former, more especially when grown on inferior soils, or when it is but indifferently ripened. For this reason we believe that the English mills are not so relatively valuable on poor and late districts as they are in others where there is more strength or bone in the straw, which greatly assists the rubbing action. Any little doubts which the Judges had in making up their minds in placing the machines on the premium list, were soon dispelled when their powers of thrashing oats were put to the test. From the temporary manner in which many of the *horse-power* machines were fixed to the ground, they did not work sweetly, and in one case led to a breakage.

FANNERS.

Both the premium *corn fanners* were deserving of attention, from the good workmanship and the satisfactory manner in which they performed the work. Their other merits were pretty equally balanced; but the price of one being £15, and the other £9, 10s., this had, without doubt, a considerable influence with the judges in making the awards. Though there was only one exhibited as *grass-seed fanners*, yet the construction and workmanship were so excellent as to well deserve a premium.

WEIGHING-MACHINES.

The *weighing-machines for grain* were highly creditable to all the exhibitors. The prize machine, entirely made of iron, exclusive of weights, was £2, 12s. 6d. The second prize, to a machine made partly of wood and of iron, at the price of £2, 10s. Both were simple in construction, and, at the same time, had all the appearance of efficiency and durability. Of *weighing-machines from 1 lb. to 2 tons* there were as many as ten entries, forming an excellent exhibition of this sort. Several of them had compound index levers, which may be exceedingly suitable when placed in connection with a building, but are not so well adapted for ordinary farm purposes, and they add considerably to the cost. The moderate price of the premium machine, conjoined with simplicity of construction and high class workmanship, would also, in this case, very properly form a considerable element in making the awards.

STRAW-CUTTING MACHINES.

There were as many as eighteen entries of straw-cutters for hand-power, and the great majority were excellent. These machines are coming rapidly into use, more especially on small dairy farms, where steaming or boiling hay or chaff is practised. A capital opportunity was afforded of selecting a good article. In hand-machines Richmond & Chandler's cut 21 lbs. of straw in 3 minutes and 21 seconds, while Page's took 19 seconds more. But for power, Page's did its work admirably—cutting 14 lbs. of straw in 20 seconds, while Richmond & Chandler's took 32 seconds.

TURNIP CUTTERS AND PULPERS.

Nothing worthy remark in improvements of *machines for cutting turnips for sheep or cattle.* There were four entries of *turnip-cutters attachable to a cart.* Caldow & M'Kinnell have well-nigh hit the nail on the head in inventing their machine, though in its present form it scarcely complied with the terms of the premium. It was *not attachable to a cart,* but was more strictly speaking a turnip cutting cart or *cart turnip cutter.* In fact, it is an ordinary cart, whose sides form a large hopper to a cutter for sheep, on Gardner's principle, and driven by gearing from the wheels. It is too much to expect that such an implement—however complete in its action—costing £15, will come into very general use, more especially as it will only be used for a limited period in the year. Surely it would not be a very heavy tax on the ingenuity of the makers to have a movable bottom fitted to the cutter, and the cutter itself screwed off, to permit of its being used as a common cart, when not needed for slicing turnips, and strewing them over grass fields. With one exception the cutters themselves in this section were not good ones, as they made the pieces much too large and rough. Twelve entries of excellent *pulping-machines,* against one of very inferior construction at Edinburgh, gave a greatly increased interest to this section. The remembrance of the last severe winter, and scarcity of keep for stock, made many look with something more than mere curiosity at these new machines. It was only after a careful trial of the quality of the work performed, and of the ease of working the machines, that the Judges distributed the awards.

LINSEED-CAKE AND GRAIN BREAKERS.

The numerous entries in the respective sections of these machines bore testimony of the strides which have been made in their manufacture. Cheapness and efficiency have gone side by side in no inconsiderable way. Quality of work done and power demanded were the means adopted in arriving at a decision where the competition was pretty close.

HAY RACKS AND TURNIP TROUGHS—HURDLES FOR SHEEP.

The *racks* were all of iron, and the prices, considering quality of material and workmanship, exhibit the economical application of this enduring material to an article which is subjected to great tear and wear from the atmosphere. There was only one *sheep trough* on the ground. It was not by any means low in price, or commendable for its structure. It makes a far better sheep trough than those to be seen most commonly in use; to have the mouth a few inches narrower than at the bottom, to which, though it looks a little odd at first sight, there is no practical objection, when well set up from the ground. It not only takes in less rain, but it does not allow chaff, cake, or grain to be so readily blown out by winds. Taking the style, size, workmanship, and price of the *wooden hurdles* into consideration, we never saw anything of the sort which gave us less satisfaction. Bain, M'Nicol, & Young's *iron netting for sheep fence* was worthy of a close inspection.

DAIRY UTENSILS.

Such a display of articles of the dairy, from the churn and cheese press to the butter roller and cooler, has seldom or never been seen at any meeting of the Society. Unless purchasers of the articles took it for granted that the premiums were rightly awarded, it would have required no little time and skill to decide which was best where all were good.

CARTS.

As is usual at the meetings of the Society, there were a large number of *carts* on the ground. The style and structure in the different sections varied considerably. If anything, the general run of the carts were rather heavy for ordinary farm work. The most of the tipping and slanting fittings were neither very efficient nor easily worked. The sheaths or floor bearers, too, were commonly morticed instead of being bolted down to the frame, which serves to impart a heavy appearance to the cart sides, which must be made thicker and stronger in the one case than the other. Williamson's, of Thornhill, in the *harvest cart section*, was a capital and strongly built article for the money, while Crosskill's was beautifully finished and altogether elegant. To many, however, it might appear too fine for the rough wear and tear of ordinary farm work. For the *light spring cart*, the high class workmanship of this celebrated firm was more in keeping with the uses and design of the article. *The special premium by the Right Honourable Lord Ashburton, to the inventor of the best drag for the common cart, to be exhibited in working order*, called forth as many as fourteen competitors. The *drag* of the premium cart was self-acting. It is made by fixing both the draught and breeching to hooks attached to iron rods, which take off or press the drag on the wheel as the horse draws

or as it pushes back on descending an incline. This seemed a likely enough method of working out a very desirable object. The most of the other drags abounded in complications, and did not seem fitted to answer the end in view. Too frequently the dragging went before everything else, and the tipping and inclining arrangements were much interfered with, and, indeed, commonly left out. We have seen a much more effective and cheaper drag than any exhibited, though not self-acting. It is formed by a hook on the end of an iron rod, so as to catch the axle and allow of a wooden cross bar to be pressed with a screw on the back of the wheels. The cross bar being merely hung with chains from the heels of the cart, can be easily taken off or on at pleasure, without adding a single bolt or nail to the cart, or interfering with the common lock and tipping gear.

DIVISIONS, MANGERS, RACKS, AND HARNESS FOR HORSES.

In all these there were considerable variety in finish and style, to suit those who aimed at utility alone, and those who combined it with the fanciful and ornamental. Downie of Corstorphine showed a set of good and moderately priced harness, while Weir of Dumfries had one at double the money, the extra price being expended in richly finished work, which attracted much attention.

STACK PILLARS.

There were three entries for *Stack Pillars*. The round-headed ends of the iron framing fitting into round sockets, exhibited a simple and substantial method of dispensing with nut and screw. This amply showed also the vast superiority of iron to wooden framing, as the former can be so readily moved from one place to another.

IRON GATES, HURDLES, AND OTHER FENCING.

The premium field gate was remarkable for cheapness, and the price at which such an article can be sold will make them be substituted largely for the wooden.

TILE MACHINES.

The working of Page's pipe and tile machines drew crowds of admiring spectators. Indeed, its rapidity and nicety of working was one of the great wonders of the show ground. When worked by power, one of these machines, it is said, can be made to turn out 40,000 two-inch pipes in a day.

EXTRA AND GENERAL COLLECTION OF IMPLEMENTS AND MACHINES.

The gradually increasing number of entries under these heads show that they are becoming into greater favour with exhibitors. The number of articles which some of our Scotch implement makers

have entered on the list, indicates that new and large firms are now rising in the trade on this side the border. Many of the entries, however, are duplicates of what are exhibited in competition. Our limits do not permit us to enter into an enumeration of the articles which might have been better brought into notice by forming them into sections. Indeed, it would have taken too much time to have run back and forward through these collections to compare individual merits in the same class of machines. We observed three or four hay-making or tedding machines, which are finding their way pretty largely into Scotland, scattered through the extra and general collections, and which would no doubt have been better examined in a section by themselves. This department affords an opportunity for every novelty in agricultural tools and machinery being introduced to the notice of the public. Indeed, a pretty wide margin is given, so that everything that can be considered of use on a farm, from the washing and mangling machines to the gas-making apparatus and garden chairs, finds a place. Caldow & M'Kinnel's numerous array made a favourable impression as to the local enterprise in agricultural machinery-making. Hornsby's high-class articles, with his famous ploughs, was a collection which we could have ill spared. Middleton's show of iron-fencing, and incomparable straining posts for wire, deservedly drew a large amount of attention. Indeed the articles in the extra and general collections were richly suggestive to the practical agriculturists, and the crowds who surrounded them on the show-day was a good criterion of the interest which they created.

AWARD OF PREMIUMS.

CLASS I.—CATTLE.

POLLED GALLOWAY.

Judges—JOHN GRAHAM of Shaw, Lockerby; and ROBERT SWAN of Brae Dumfries. *Attending Member*—J. S. WIGHTMAN of Courance, Lockerby.

SECTION

1. Best Bull, calved before 1st January 1858—L.20 to James Beattie, Newbie House, Annan. Second—L.10 to Samuel Thomson, Blaiket, Crocketford, Dumfries. Third—The bronze medal to James Graham, Meikle Culloch, Dalbeattie. The silver medal to James Beattie, Newbie House, Annan, as the *Breeder* of the Best Bull.
2. Best Bull, calved after 1st January 1858—L.20 to Robert Stobo, Halliday Hill, Dumfries. Second—L.10 to John Cunningham, Whitecairn, Kirkpatrick-Durham. Third—The bronze medal to James Beattie, Newbie House, Annan.
3. Best Bull, calved after 1st January 1859—L.10 to James Beattie, Newbie House, Annan. Second—L.5 to John Birrel, Guards,

Gretna. Third—The bronze medal to Patrick Dudgeon of Cargen, Dumfries.

4. Best Cow of any age—L.15 to James Graham, Meikle Culloch, Dalbeattie. Second—L.8 to W. and J. Shennan, Balig, Kirkcudbright. Third—The bronze medal to James Graham, Meikle Culloch, Dalbeattie.
5. Best Heifer, calved after 1st January 1858—L.10 to W. and J. Shennan, Balig, Kirkcudbright. Second—L.5 to James Graham, Meikle Culloch, Dalbeattie. Third—The bronze medal to John Wallace, Langbarns, Kirkcudbright.
6. Best Heifer, calved after 1st January 1859—L.8 to John Cunningham, Whitecairn, Kirkpatrick-Durham. Second—L.4 to W. and J. Shennan, Balig, Kirkcudbright. Third—The bronze medal to the Duke of Buccleuch.

EXTRA POLLED GALLOWAY.

The medium gold medal was awarded to James Graham, Meikle Culloch, Dalbeattie, for a Cow, age 5 years and 5 months, *winner of the first premium at Glasgow in* 1857.

The Judges commended the following:—Two Heifers, belonging to the Duke of Buccleuch; an Ox, belonging to Wellwood Maxwell of Glenlee, New Galloway; and an Ox, belonging to Robert Stobo, Halliday Hill, Dumfries.

POLLED ANGUS OR ABERDEEN.

Judges—ROBERT HECTOR, 4 Union Street, Montrose; and GEORGE MILNE, Haddo, Methlic, Aberdeen. *Attending Member*—WELLWOOD HERRIES MAXWELL of Munches, Dalbeattie.

7. Best Bull, calved before 1st January 1858—L.20 to Alexander Bowie, Mains of Kelly, Arbroath. Second—L.10—*No competition.* The silver medal to William M'Combie, Tillyfour, Aberdeen, as the *Breeder* of the Best Bull.
8. Best Bull, calved after 1st January 1858—L.20 to William M'Combie, Tillyfour, Aberdeen. Second—L.10 to George Brown, Westertown, Fochabers. Third—The bronze medal—*No competition.*
9. Best Bull, calved after 1st January 1859—L.10 to the Trustees of the late Robert Scott, Balwyllo, Brechin. Second—L.5—*No competition.* Third—The bronze medal—*No entry.*
10. Best Cow of any age—L.15 to William M'Combie, Tillyfour, Aberdeen. Second—L.8 to John Collie, Ardgay, Forres. Third—The bronze medal to George Brown, Westertown, Fochabers.
11. Best Heifer, calved after 1st January 1858—L.10 to George Brown, Westertown, Fochabers. Second—L.5 to John Collie, Ardgay, Forres. Third—The bronze medal to William M'Combie, Tillyfour, Aberdeen.
12. Best Heifer, calved after 1st January 1859—L.8 to the Trustees of the late Robert Scott, Balwyllo, Brechin. Second—L.4 to William M'Combie, Tillyfour, Aberdeen. Third—the bronze medal to the Trustees of the late Robert Scott, Balwyllo, Brechin.

EXTRA POLLED ANGUS OR ABERDEEN.

The medium gold medal was awarded to William M'Combie, Tillyfour, Aberdeen, for each of the following lots:—Cow, age 7 years, *Winner of the 1st Premium at Inverness in* 1856, *and 1st Premium at the International Show at Paris,* 1856. Cow, age 5 years, *Winner of the 1st Premium at Aberdeen in* 1858. Cow, age 9 years, *Winner of the 1st Premium at Berwick in* 1854. Cow, age 7 years, *Winner of the 1st Premium at Glasgow in* 1857.

The gold medal, offered by M. Dubrone for the best polled Bull in the Yard, was awarded to James Beattie, Newbie House, Annan, for a polled Galloway Bull, age 5 years and three months.

SHORT-HORN.

Judges—THOMAS CROFTON, Holywell, Durham; WILLIAM CATTLE, Dormont Grange, Ecclefechan; and GEORGE SHEPHERD, Shethin, Tarves. *Attending Member*—J. GILCHRIST CLARK of Speddoch, Dumfries.

13. Best Bull, calved before 1st January 1858—L.20 to William Lambert, Elsington Hall, Haydon Bridge. Second—L.10 to Viscount Strathallan, Strathallan Castle, Auchterarder. Third—The bronze medal to Viscount Strathallan. The silver medal to John Aitkinson, Bywell Hall Farm, Stocksfield, as the *Breeder* of the best Bull.

14. Best Bull, calved after 1st January 1858—L.20 to David Ainslie of Costerton, Blackshiels. Second—L.10 to Lord Kinnaird, Rossie Priory, Inchture. Third—The bronze medal to Lord Kinnaird.

15. Best Bull, calved after 1st January 1859—L.10 to John Aitkinson, Peepy, Stocksfield, Newcastle-on-Tyne. Second—L 5 to Messrs Turnbull, Bonhill Place, Dumbarton. Third—The bronze medal to James Hozier of Newlands, Mauldslie Castle, Carluke.

16. Best Cow of any age—L.15 to James Douglas, Athelstaneford, Drem. Second—L.8 to Thomas Atherton, Chapel House, Spike, Liverpool. Third—The bronze medal to Viscount Strathallan.

17. Best Heifer, calved after 1st January 1858—L.10 to James Douglas, Athelstaneford, Drem. Second—L.5 to Captain Robert Gunter, The Grange, Wetherby, Yorkshire. Third—The bronze medal to Captain Robert Gunter, The Grange, Wetherby.

18. Best Heifer, calved after 1st January 1859—L.8 to James Douglas, Athelstaneford, Drem. Second—L.4 to James Douglas, Athelstaneford, Drem. Third—The bronze medal to James Douglas, Athelstaneford, Drem.

EXTRA SHORT-HORN.

The medium gold medal was awarded to James Douglas, Athelstaneford, Drem, for each of the following lots:—Cow, age 5 years, 8 months, and 6 days, *Winner of 1st Premium at Glasgow in* 1857. Cow, age 4 years, 6 months, and 5 days, *Winner of 1st Premium at Edinburgh in* 1859. A Heifer, age 3 years.

AYRSHIRE.

Judges—PATRICK GRAHAM BARNS of Limekilns, East Kilbride ; QUINTIN BONE, Greenan, Ayr ; JAMES POLLOCK, Raws, Kilmarnock. *Attending Member*—DAVID M'CULLOCH, Auchness, Stranraer.

19. Best Bull, calved before 1st January 1858—L.20 to John Stewart, Burnside Cottage, Strathaven. Second—L.10 to Tudhope, and Todd, Poniel, Douglas. Third—The bronze medal to the Duke of Buccleuch and Queensberry. The silver medal to Mr Dunn, Helensburgh, as the *Breeder* of the best Bull.
20. Best Bull, calved after 1st January 1858—L.10 to John Marshall, Airbles Farm, Motherwell. Second—L 5 to John Stewart, Burnside Cottage, Strathaven. Third—The bronze medal to John Stewart, Burnside Cottage, Strathaven.
21. Best Cow in Milk of any age—L.10 to John Marshall, Airbles Farm, Motherwell. Second—L.5 to John Stewart, Burnside Cottage, Strathaven. Third—The bronze medal to H. D. B. Hyslop, Tower, Kirkconnel.
22. Best Cow in Calf of any age—L.10 to John Parker, Nether Broomlands, Irvine. Second—L.5 to John Stewart, Burnside Cottage, Strathaven.
23. Best Heifer, calved after 1st January 1858—L.8 to John Parker, Nether Broomlands, Irvine. Second—L.4 to the Duke of Buccleuch and Queensberry. Third—The bronze medal to H. D. B. Hyslop, Tower, Kirkconnel.
24. Best Heifer, calved after 1st January 1859—L 6 to John Stewart, Strathaven. Second—L.3 to John Marshall, Airbles Farm, Motherwell. Third—The bronze medal to the Duke of Bucleuch.

HIGHLAND.

Judges—ALEXANDER DENHOLM, Baitlaws, Biggar; Captain KENNEDY of Finnart, Girvan ; and DUNCAN MITCHELL, Blairvockie, Luss. *Attending Member*—JAMES CONNELL of Conheath, Irvine House, Langholm.

25. Best Bull, calved before 1st January 1858—L.20 to Allan Pollok of Ronachan, Tarbert, Second—L.10—*No entry.* Third – The bronze medal—*No entry.* The silver medal to R. D. Campbell of Jura, as the *Breeder* of the best Bull.
26. Best Bull, calved after 1st January 1858—*No Entry.*
27. Best Cow of any Age—L.10 to the Duke of Hamilton and Brandon, Arran—(*Under Protest.*) Second—L.5 to Allan Pollok, Ronachan, Tarbert. Third—The bronze medal to Allan Pollok, Ronachan, Tarbert.
28. Best Heifer, calved after 1st January 1857—L.8 to Allan Pollok, Ronachan, Tarbert. Second—L.4 to Allan Pollok, Ronachan, Tarbert. Third—The bronze medal—*No entry.*
29. Best Heifer, calved after 1st January 1858—L.6 to Allan Pollok, Ronachan, Tarbert. Second—L.3 to Allan Pollok, Ronachan, Tarbert. Third—*No award.*

FAT STOCK.

Judges—JOHN HAIG, Cameron Bridge, Windygates, Fife ; GEOREG HAR-

VEY, Whittingham Mains, Prestonkirk; JOHN PAYNE, Flesher, Dumfries. *Attending Member*—J. A. SHAW STEWART of Carnock, Stirling.

30. Best Cross Ox, calved after 1st January 1857—The medium gold medal to David Ainslie, Costerton, Blackshiels. Second—The silver medal to James Stewart Newmarket, Aberdeen. Third—The bronze medal to James Stewart, Newmarket, Aberdeen.
31. Best Cross Ox, calved after 1st January 1858—The medium gold medal to John Hunter, Dipple, Fochabers. Second—The silver medal to Robert Husband, Gellet, Dunfermline. Third—The bronze medal—*No competition.*
32. Best Polled Ox, calved after 1st January 1857—The medium gold medal to Wellwood Maxwell of Glenlee, New Galloway. Second—The silver medal to Wellwood Maxwell of Glenlee, New Galloway. Third—The bronze medal to the Duke of Buccleuch.
33. Best Polled Ox, calved after 1st January 1858—The medium gold medal to John Collie, Ardgay, Forres. Second—The silver medal to John Collie, Ardgay, Forres. Third—The bronze medal to the Duke of Buccleuch.

EXTRA CATTLE.

The Judges highly commended—Five Highland Oxen, belonging to Misses Baird of Closeburn; and a Cross Ox, belonging to Robert Osburn, Hitchell, Cummertrees, Annan.

CLASS II.—HORSES

FOR AGRICULTURAL PURPOSES.

Judges—Stallions: ROBERT FINDLAY, Springhill, Baillieston; JAMES STEEDMAN, Boghall, Roslin. *Attending Member*—Captain DIROM of Mount Annan, Annan.

Judges—Mares: GEORGE TOD, Lochran, Blair-Adam; and JOHN WAUGH, St John's Kirk, Biggar. *Attending Member*—Col. GRAHAM of Mossknow, Lockerby.

Section

1. Best Stallion, foaled before 1st Jan. 1857—L.30 to David Riddell, Kilbowie, Duntocher. Second—L.15 to William Kerr, Lochend, Kilbirnie. Third—The bronze medal to John Barr, Barangry, Bishopton. The silver medal to George Scott, Barr, Largs, as the *Breeder* of the best Stallion.
2. Best Entire Colt, foaled after 1st January 1857—L.20 to Andrew Logan, Crossflat, Kilbarchan. Second—L.10 to John Frazer, Overton, New Abbey. Third—The bronze medal to Robert Lochhead, Glenshinnoch, Bishopton.
3. Best Entire Colt, foaled after 1st January 1858—L.15 to James Salmon, Benston, Paisley. Second—L.8 to Peter Crawford, Dumgoyack, Strathblane. Third—The bronze medal to John Buchanan, Coldrach, Drymen.
4. Best Entire Colt, foaled after 1st January 1859—L.10 to Matthew Kerr, Gree, Beith. Second—L.5 to James Proudfoot, Templand, Lochmaben. Third—The bronze medal to Alexander M'Lachlan, Easter Longhaugh, Bishopton.

5. Best Mare (with foal at foot), foaled before 1st January 1857—L.20 to James Douglas, Athelstaneford, Drem. Second—L.10 to Robert Morton, Dalmuir, Old Kilpatrick. Third—The bronze medal to James Salmon, Benston, Paisley.
6. Best Mare (in foal), foaled before 1st January 1857—L.15 to William Rigg, Banks, Kirkcudbright. Second—L.8 to John Watson, Bathvale, Glasgow. Third—The bronze medal to James Beattie, Newbie House, Annan.
7. Best Filly, foaled after 1st January 1857—L.10 to John Anderson, Smithston, Kilsyth. Second—L.5 to John Muir, Lochfergus, Kirkcudbright. Third—The bronze medal to William Little, Fitz, Aspatria.
8. Best Filly, foaled after 1st January 1858—L.8 to Wm. Aikenhead, Shawmoss, Pollockshaws. Second—L.4 to John Kerr, Morton, Mid-Calder. Third—The bronze medal to James Walker, Cawder Cuilt, Maryhill.
9. Best Filly, foaled after 1st January 1859—L.6 to William Kerr, Wester Causewayend, Mid-Calder. Second—L.3 to George Henderson, Airdrie, Kirkbean. Third—The bronze medal to John Frazer, Overton, New Abbey.

EXTRA HORSES.

The Judges commended—an Arabian Colt, belonging to John Ritchet, Pennersaughs, Ecclefechan; and a Hunting Horse, belonging to John W. J. Paterson, Terrona, Langholm.

Class III.—SHEEP.

CHEVIOT.

Judges—James Oliver, Howpasley, Hawick; James Paterson, Chapel Hill, Hawick; Alexander Denholm, Baitlaws, Biggar. *Attending Member*—Sir William Baillie of Polkemmet, Bart.

Section

1. Best Tup, not more than four shear—L.10 to James Brydon, Moodlaw, Langholm. Second—L.5 to James Brydon, Moodlaw, Langholm. Third—The bronze medal to Thomas Brydon, Kinnelhead, Moffat.
2. Best Dinmont or Shearling Tup—L.10 to Robert Borland, Auchencairn, Closeburn. Second—L 5 to Thomas Brydon, Kinnelhead, Moffat. Third—The bronze medal to James Brydon, Moodlaw, Langholm.
3. Best Pen of Five Ewes, not more than four shear—L.8 to Thomas Brydon, Kinnelhead, Moffat. Second—L.4 to Thomas C. Borthwick, Hopsrig, Langholm. Third—The bronze medal to Robert Borland, Auchencairn, Closeburn.
4. Best Pen of Five Shearling Ewes or Gimmers—L.8 to James Brydon, Moodlaw, Langholm. Second—L.4 to Thos. Welsh, Earlshaugh, Moffat. Third—The bronze medal to Thomas C. Borthwick, Hopsrig, Langholm.

BLACKFACED.

Judges—Alexander Denholm, Baitlaws, Biggar; Captain Kennedy,

of Finnart, Girvan; and DUNCAN MITCHELL, Blairvockie, Luss. *Attending Member*—JAMES CONNELL of Conheath, Irvine House, Langholm.

5. Best Tup, not more than four shear—L.10 to Walter Murray, Walston, Penicuik. Second—L.5 to Thomas Brydon, Kinnelhead, Moffat. Third—The bronze medal to James Drife, Barr, Sanquhar.
6. Best Dinmont or Shearling Tup—L.10 to James Drife, Barr, Sanquhar. Second—L.5 to Thomas Murray, Eastside, Penicuik. Third—The bronze medal to Thomas Murray, Eastside, Penicuik.
7. Best Pen of Five Ewes, not more than four shear—L.8 to James Milligan, Hayfield, Thornhill. Second—L.4 to Allan Pollok, Ronachan, Tarbert. Third—The bronze medal to Thomas Murray, Eastside, Penicuik.
8. Best Pen of Five Shearling Ewes or Gimmers—L.8 to James Moffat, Gateside, Kirkconnel. Second—L.4 to James Drife, Barr, Sanquhar. Third—The bronze medal to Thomas Murray, Eastside, Penicuik.

LEICESTER.

Judges—JOSEPH BELL, Scalehill, Lazonby, Penrith; GEORGE HOPE, Fentonbarns, Drem; and GEORGE TAYLOR, Sewerby Cottage, Burlington. *Attending Member*—H. G. MURRAY STEWART of Broughton.

9. Best Tup, not more than four shear—L.10 to James Beattie, Newbie House, Annan. Second—L.5 to Thomas Cockburn, Sisterpath, Dunse. Third—The bronze medal to James Beattie, Newbie House, Annan.
10. Best Dinmont or Shearling Tup—L.10 to James Beattie, Newbie House, Annan. Second—L.5 to Thomas Cockburn, Sisterpath, Dunse. Third—The bronze medal to Thomas Cockburn, Sisterpath, Dunse.
11. Best Pen of Five Ewes, not more than four shear—L.8 to John Collie, Ardgay, Forres. Second—L.4—*No competition.* Third—The bronze medal—*No entry.*
12. Best Pen of Five Shearling Ewes or Gimmers—L.8 to George Simson, Courthill, Kelso. Second—L.4 to George Simson, Courthill, Kelso. Third—The bronze medal to James Melvin, Bonnington, Ratho.

LONG-WOOLLED SHEEP OTHER THAN LEICESTER.

Judges—JOSEPH BELL, Scalehill, Lazonby, Penrith; GEORGE HOPE, Fentonbarns, Drem; and GEORGE TAYLOR, Sewerby Cottage, Burlington. *Attending Member*—H. G. MURRAY STEWART of Broughton.

13. Best Tup, not more than four shear—L.10 to Edward Handy, Sierford, Cheltenham. Second—L.5 to John Gibson, Woolmet, Dalkeith. Third—The bronze medal to Lord Kinnaird, Rossie Priory, Inchture.
14. Best Dinmont or Shearling Tup—L.10 to Edward Handy, Sierford, Cheltenham. Second—L.5 to Edward Handy, Sierford, Cheltenham. Third—The bronze medal to Lord Kinnaird, Rossie Priory, Inchture.

15. Best Pen of Five Ewes, not more than four shear—L.8 to Robert Robison, Marks, Kirkcudbright. Second—L.4 to John Gibson, Woolmet, Dalkeith. Third—The bronze medal to Lord Kinnaird, Rossie Priory, Inchture.
16. Best Pen of Five Shearling Ewes or Gimmers—L.8 to Robert Scot Skirving, Camptoun, Drem. Second—L.4 to Lord Kinnaird. Third—The bronze medal to John Muir, Lochfergus, Kirkcudbright.

SOUTHDOWN.

Judges—THOMAS CROFTON, Holywell, Durham; WILLIAM CATTLE, Dormont Grange, Ecclefechan; and GEORGE SHEPHERD, Shethin, Tarves. *Attending Member*—J. GILCHRIST CLARK of Speddoch, Dumfries.

17. Best Tup, not more than four shear—L.10 to the Duke of Richmond, Gordon Castle, Fochabers. Second—L.5 to the Duke of Richmond. Third—The bronze medal to Robert Scot Skirving, Camptoun, Drem.
18. Best Dinmont or Shearling Tup—L.10 to the Duke of Richmond. Second—L.5 to Robert Scot Skirving, Camptoun, Drem. Third—The bronze medal to the Duke of Richmond.
19. Best Pen of Five Ewes, not more than four shear—L.8 to Robert Lyall, Old Montrose, Brechin. Second—L.4 to Robert Scot Skirving, Camptoun, Drem. Third—The bronze medal—*No entry*.
20. Best Pen of Five Shearling Ewes or Gimmers—L.8 to the Duke of Richmond. Second—L.4 to Robert Scot Skirving, Camptoun, Drem. Third—The bronze medal—*No entry*.

EXTRA SHEEP.

The Judges commended—Five Shearling Cheviot Wethers, belonging to Robert Brown, Cassylands, Dumfries.

CLASS IV.—SWINE.

Judges—JONATHAN BROWN, Aspatria, Cumberland; JOHN CURROR, Comiston, Colinton; and JOHN SWAN, Edinburgh. *Attending Member*, —NIVEN MATTHEWS, Whitehills, Garlistown.

Section

1. Best Boar, large breed—L.8—*No competition*. Second—L.4—*No entry*.
2. Best Boar, small breed—L.8 to George Mangles, Givendale, Ripon. Second—L.4 to Joseph Hindson, Barton House, Everton, Liverpool. Third—The bronze medal to Miss Bell, Woodhouselees, Canonbie.
3. Best Sow, large breed—L.6 to William MacDuff, Longbridgemoor. Annan. Second—L.3 to Miss Bell, Woodhouselees, Canonbie. Third—The bronze medal to Miss Bell, Woodhouselees.
4. Best Sow, small breed—L.6 to John Mackay, Cross-Arthurlie, Barrhead. Second—L.3 to George Mangles, Givendale, Ripon. Third—The bronze medal to George Mangles, Givendale, Ripon.
5. Best Pen of Three Pigs, not exceeding eight months old, large breed—L.4—*No competition*. Second—L.2—*No entry*.

6. Best Pen of Three Pigs, not exceeding eight months old, small breed—L.4 to George Mangles, Givendale, Ripon. Second—L.2 to the Earl of Wemyss and March, Gosford, Drem. Third—The bronze medal—*No award.*

Class V.—POULTRY.

Judges—Lord Binning, Mellerstain, Kelso; Jonathan Brown, Aspatria; and Peter Turner, Haggs, Mid-Calder.

Section

1. Best Coloured Dorking Cock and Two Hens—The silver medal to Bradshaw Barker, Wysebyhill, Ecclefechan. Second—The bronze medal to Miss Bell, Woodhouselees, Canonbie.
2. Best Coloured Dorking Cockerel and Two Pullets—The silver medal to the Earl of Wemyss and March, Gosford, Drem. Second—The bronze medal to Miss Bell, Woodhouselees, Canonbie.
3. Best White Dorking Cock and Two Hens—The silver medal—*No entry.*
4. Best White Dorking Cockerel and Two Pullets—The silver medal to Thomas D. Findlay, Easterhill, Glasgow. Second—The bronze medal—*No award.*
5. Best Coloured Cochin-China Cock and Two Hens—The silver medal to David Stratton, Mid-Calder. Second—The bronze medal to Miss Hope Johnstone, Marchbank Farm, Moffat.
6. Best Coloured Cochin-China Cockerel and Two Pullets—The silver medal to David Stratton, Mid-Calder. Second—The bronze medal—*No entry.*
7. Best White Cochin-China Cock and Two Hens—The silver medal—*No competition.* Second—The bronze medal—*No entry.*
8. Best White Cochin-China Cockerel and Two Pullets—*No entry.*
9. Best Bramahpootra Cock and Two Hens—The silver medal—*No award.* Second—*No entry.*
10. Best Bramahpootra Cockerel and Two Pullets—The silver medal to Lord Kinnaird, Rossie Priory, Inchture. Second—The bronze medal to Lord Kinnaird, Rossie Priory, Inchture.
11. Best Malay Cock and Two Hens—The silver medal—*No entry.*
12. Best Malay Cockerel and Two Pullets—The silver medal—*No entry.*
13. Best Spanish Cock and Two Hens—The Silver Medal to Mrs Paton, View Villa, Kilmarnock. Second—The bronze medal to Alexander Cockburn, Gogar Bank Cottage, Corstorphine.
14. Best Spanish Cockerel and Two Pullets—The silver medal to Mrs Paton, View Villa, Kilmarnock. Second—*No entry.*
15. Best Golden Hamburg Cock and Two Hens—The silver medal to Mrs Maxwell of Munches, Dalbeattie. Second—The bronze medal to Miss Hope Johnstone, Marchbank, Moffat.
16. Best Golden Hamburg Cockerel and Two Pullets—The silver medal—*No entry.*
17. Best Silver Hamburg Cock and Two Hens—The silver medal to Mrs Whitaker, Kelton Mains, Dumfries. Second—The bronze medal to Miss Hope Johnstone.

18. Best Silver Hamburg Cockerel and Two Pullets—The silver medal to Mrs Whitaker, Kelton Mains, Dumfries. Second—*No entry.*
19. Best Polish Cock and Two Hens—The silver medal—*No entry.*
20. Best Polish Cockerel and Two Pullets—The silver medal—*No entry.*
21. Best Game Cock and Two Hens—The silver medal to Mrs Parker, Coalstaith, Brampton. Second—The bronze medal to Mrs Parker, Coalstaith, Brampton.
22. Best Game Cockerel and Two Pullets—The silver medal to Mrs Parker, Coalstaith, Brampton. Second—*No entry.*
23. Best Cock and Two Hens, any other breed—The silver medal to Mrs Burney Brown, Carthagena, Dumfries. Second—The bronze medal to Mrs Brown, Nith House, Dumfries.
24. Best Cockerel and Two Pullets, any other breed—The silver medal —*No entry.*
25. Best Bantam Cock and Two Hens—The silver medal to Wellwood Maxwell of Glenlee, New Galloway. Second—The bronze medal to David Ainslie of Costerton, Blackshiels.
26. Best Bantam Cockerel and Two Pullets—The silver medal—*No entry.*
27. Best Three Capons of any breed—The silver medal—*No entry.*
28. Best White Aylesbury Drake and Two Ducks—The silver medal—*No award.*
29. Best Rouen Drake and Two Ducks—The silver medal—*No award.*
30. Best Drake and Two Ducks, any other breed—The silver medal—*No award.*
31. Best Black Norfolk Turkey Cock and Two Hens—The silver medal to Adam Skirving of Croys, Kirkpatrick-Durham. Second—The bronze medal to Lord Kinnaird, Rossie Priory, Inchture.
32. Best Turkey Cock and Two Hens, any other breed—The silver medal to Miss Hope Johnstone, Marchbank, Moffat. Second—The bronze medal to Miss Hope Johnstone, Stidriggs Farm, Moffat.
33. Best Gander and Two Geese—The silver medal to Lord Kinnaird, Rossie Priory, Inchture. Second—The bronze medal to William Irving, Barndennoch, Auldgirth, Dumfries.

EXTRA POULTRY.

The Judges commended the following :—Gander and Goose belonging to Miss Hope Johnstone, Stidriggs Farm, Moffat; Two Hens belonging to William Thomson, Oxgang, Dumfries.

CLASS VI.—DAIRY PRODUCE.

Judges—WILLIAM BROWN of Greenock Mains, Muirkirk; THOMAS GIBSON, Edinburgh; DAVID LENNOX, Dumfries; and FRANCIS RICHARDSON, Edinburgh. *Attending Member*—LAURENCE ANDERSON, Chapel, Moffat.

Section

1. Best sample of Cured Butter—L.5 to Samuel Thomson, Blaiket, Crocketford, Dumfries. Second—L.3 to Mrs Burgess, Lambholm, Kirkmichael, Dumfries. Third—The bronze medal to Donald M'Farlane, Balmuldy, Bishopbriggs.
2. Best sample of Powdered Butter—L.5 to Mrs Chisholm, Bankhead,

Tinwald, Dumfries. Second—L.3 to Mrs Fleming, Waterfoot, Annan. Third—The bronze medal to Mrs Sloan, Horseholm, Dumfries.

3. Best sample of Fresh Butter—L.5 to John Adam, Closeburn, Thornhill. Second—L 3 to Adam Skirving of Croys, Dumfries. Third—The bronze medal to Mrs Smith, Blairmuckhole, Shotts, Lanarkshire.
4. Best Two Sweet-Milk Cheeses—L.5 to John Dunlop, Whiteshawgate, Strathaven. Second—L 3 to James Caird, M.P., Baldoon, Wigtown. Third—The bronze medal to John Mackie, Sarkshields, Kirkpatrick-Fleming.
5. Best Two Skimmed-Milk Cheeses—L.5 to Andrew Gibson, Gillesbie Dairy, Lockerby. Second—L.3 to Andrew Vass, Kirkmichael, Dumfries. Third—The bronze medal to Mrs Smith, Glenmanna, Penpont.
6. Best Two English Cheeses—*No entry.*
7. Best Two Imitation English Cheeses—L.5 to William Dickie, Girlhill, Dalry, Ayrshire. Second—L.3 to Rogert Murdoch, Howwell, Kirkcudbright. Third—The bronze medal to William M'Adam, Valleyfield, Castle-Douglas.

CLASS VII.—IMPLEMENTS AND MACHINES.

JOHN GIBSON, Woolmet, Dalkeith, *Superintendent of Trial Fields;* ALEXANDER SLIGHT, Leith Walk, Edinburgh, *Practical Engineer.*

JUDGES.

Sections 1 to 37—JAMES W. HUNTER of Thurston, Dunbar; JAMES JARDINE, Dryfeholm, Lockerby; and ROBERT PATTERSON, Offers Farm, Stirling. *Attending Member*—ALEX. JARDINE, yr. of Applegarth, Lockerby.

Sections 38 to 43—GEORGE HOPE, Fentonbarns, Drem; ALEX. SCOTT, Craiglockhart, Edinburgh; ROBERT SMITH, Ladyland, Dumfries; and JAMES STIRLING, C.E., Edinburgh. *Attending Member*—WELLWOOD MAXWELL of Glenlee, New Galloway.

Sections 44 to 83—JOHN CURROR, Comiston, Edinburgh; ROBERT ELLIOT, Laighwood, Dunkeld; and JAMES MELVIN, Bonnington, Ratho. *Attending Member*—R. B WARDLAW RAMSAY of Whitehill, Lasswade.

Section

1. Best Two-horse Plough for general purposes—L.2 to John Gray and Co., Uddingston, Glasgow. Second—The bronze medal to James Halliday, Dumfries.
2. Best Trench or Deep-furrow Plough—L 2 to William M'Cormick, Dumfries. Second—The bronze medal to Robert Law, Shettleston, Glasgow.
3. Best Subsoil Plough for Two Horses—L.2 to Robert Law, Shettleston, Glasgow. Second—The bronze medal to James Kirkwood, Tranent.
4. Best Subsoil Plough for Three or Four Horses—L.3 to James Kirkwood, Tranent. Second—The bronze medal to Robert Law, Shettleston, Glasgow.
5. Best Double Mould-board Plough—L.2 to Robert Law, Shettleston,

Glasgow. Second — The bronze medal to William Jardine, Dryfebridge, Lockerbie.

6. Best Ribbing Plough—L.2 to James Kirkwood, Tranent. Second —The bronze medal—*No competition.*
7. Best Two-horse Grubber or Cultivator—L.3 to James Halliday, Dumfries. Second—The bronze medal to Caldow and M'Kinnel, Dumfries.
8. Best Norwegian Harrow or Pulverizing Land-roller—L.3 to Trustees of W. Croskill, Beverley. Second—The bronze medal to John Inglis, Craigour, Liberton.
9. Best Consolidating Land-roller—L.4 to James Kirkwood, Tranent. Second—The bronze medal to Robert Wight, Seton, Longniddry.
10. Best Land-presser for preparing Seed-bed for Grain—L.4 to G. W. Robinson, Barton-on-Humber. Second—The bronze medal to Smith Brothers and Co., Kinning Street, Glasgow.
11. Best Ribbing Machine—L.2 to James Kirkwood, Tranent. Second —The bronze medal to Mrs Thomas Sherriff, West Barns, Dunbar.
12. Best Harrows for Heavy Land—L.2 to E. H. Bentall, Heybridge, Maldon, Essex. Second—The bronze medal to Kemp, Murray, and Nicholson, Stirling.
13. Best Harrows for Light Land—L.2 to E. H. Bentall, Heybridge, Maldon, Essex. Second—The bronze medal to Kemp, Murray, and Nicholson, Stirling.
14. Best Harrows for covering Grass Seeds—L.2 to Thomas Rogerson, Trailflatwood, Dumfries. Second—The bronze medal to E. Page and Co., Bedford.
15. Best Common Swing-trees for Two Horses—L.1 to Caldow and M'Kinnel, Dumfries. Second—The bronze medal to David Burns, Whitecross, Linlithgow.
16. Best Equalising Swing-trees for more than Two Horses—L.1 to David Burns, Whitecross, Linlithgow. Second—The bronze medal to Robert Law, Shettleston, Glasgow.
17. Best Broadcast Sowing-machine for Grain—L.5 to Mrs Thomas Sherriff, West Barns, Dunbar. Second—The bronze medal to George Finlayson, Gighty Burn, Arbroath.
18. Best Drill Sowing-Machine for Grain—L.5 to Mrs Thomas Sherriff, West Barns, Dunbar. Second—The bronze medal to Kemp, Murray, and Nicholson, Stirling.
19. Best Sowing-Machine for Grass Seeds—L.5 to Kemp, Murray, and Nicholson, Stirling. Second—The bronze medal to John Burnie, Castle-Douglas.
20. Best Sowing-Machine for Turnips—L.3 to J. and T. Young, Ayr. Second—The bronze medal to Mrs Thomas Sherriff, West Barns, Dunbar.
21. Best Sowing-Machine for Turnips with Manure—L.5 to Robert and John Reeves, Bratton, Westbury, Wilts. Second—The bronze medal—*No competition.*
22. Best Dibbling or Drop Sowing-Machine with Manure—L.3—*No competition.* Second—The bronze medal—*No entry.*
23. Best Sowing-Machine for Mangold—L.3 to J. and T. Young, Ayr.

Second—The bronze medal to Wm. Turner, Whauphill, Kirkinner.

24. Best Sowing-Machine for Carrots—L.3 to Mrs Thomas Sherriff, West Barns, Dunbar. Second—The bronze medal—*No entry.*
25. Best Three-row Sowing-Machine for Beans—L.2 to Mrs Thomas Sherriff, West Barns, Dunbar. Second—The bronze medal—*No competition.*
26. Best One-row Sowing-Machine for Beans—L.1 to Alexander Jack and Son, Maybole. Second—The bronze medal to Robert Law, Shettleston, Glasgow.
27. Best Machine for Pulverising Guano, &c—L.2 to Alexander Jack and Son, Maybole. Second—The bronze medal to Mrs Thomas Sherriff, West Barns, Dunbar.
28. Best Machine for Distributing Guano in Drill or Broadcast—L 5 to Robert and John Reeves, Bratton, Westbury, Wilts. Second—The bronze medal—*No award.*
29. Best Liquid-Manure Distributing-Machine—L.4 to the Trustees of W. Crosskill, Beverley. Second—The bronze medal to Isaac James, Cheltenham.
30. Best Horse-Hoe for Drilled Grain Crops—L.4 to Mrs Thomas Sherriff, West Barns, Dunbar. Second—The bronze medal to William and James Hunter, Samuelston, Haddington.
31. Best Horse-Hoe for Green Crops—L.2 to Caldow and M'Kinnel, Dumfries. Second—The bronze medal to Caldow and M'Kinnel, Dumfries.
32. Best Machine for Singling Turnips—L.4—*No award.* Second—The bronze medal—*No entry.*
33. Best Machine for Raising Potatoes—L.4 to Robert Law, Shettleston, Glasgow. Second—The bronze medal to Smith Brothers & Co., Kinning Street, Glasgow.
34. Best Scythe for general purposes—L.1 to James Payne, Kirkcudbright. Second—The bronze medal—*No competition.*
35. Best Reaping-Machine, self-delivery—L.10 to Alexander Shank and Son, Arbroath. Second—The bronze medal—*No award.*
36. Best Reaping-Machine, manual delivery—L.10 to Gardner and Lindsay, Stirling. Second—The bronze medal to Alexander Jack and Son, Maybole.
37. Best Horse-Stubble or Hay-Rake—L.2 to James Kirkwood, Tranent. Second—The bronze medal to Caldow and Mackinnel, Dumfries.
38. Best Thrashing-Machine for two or more Horses—L.5 to John Drummond, Cumnock. Second—The bronze medal to Williamson Brothers, Kendal.
39. Best Thrashing-Machine, with Steam-power—L.20 to Robey and Co., Lincoln. Second—The bronze medal to Wilkinson, Wright and Co., Boston, Lincolnshire.
40. Best Fanners or other Machine for Winnowing Grain—L.3 to John Richardson, Brunton Place, Carlisle. Second—The bronze medal to Robert Boby, Bury St Edmunds.
41. Best Fanners or other Machine for cleaning Grass Seeds—L.3 to John Richardson, Brunton Place, Carlisle. Second—The bronze medal—*No award.*

42. Best Weighing-Machine for Grain—L.2 to A. and W. Smith & Co, Eglinton Engine Works, Glasgow. Second—The bronze medal to the Trustees of the late John Maxwell, Dumfries.
43. Best Weighing-Machine, indicating from 1 lb. to 2 tons—L.4 to A. and W. Smith & Co., Eglinton Engine Works, Glasgow. Second—The bronze medal to Smith Brothers & Co., Kinning Street, Glasgow.
44. Best Straw-Cutter for Hand-labour—L.2 to Richmond and Chandler, Salford. Second—The bronze medal to E. Page and Co., Bedford.
45. Best Straw-Cutter for Power—L.3 to E. Page and Co., Bedford. Second—The bronze medal to Richmond and Chandler, Salford.
46. Best Turnip-Cutter for Cattle—L.2 to Caldow and M'Kinnel, Dumfries. Second—The bronze medal to John Wingate, Alloa.
47. Best Turnip-Cutter for Sheep—L.2 to the Trustees of the late John Maxwell, Dumfries. Second—The bronze medal to Caldow and M'Kinnel, Dumfries.
48. Best Turnip-Cutter for Sheep, attachable to a Cart—L.3 to Caldow and M'Kinnel, Dumfries. Second—The bronze medal to Mrs Thomas Sherriff, West Barns, Dunbar.
49. Best Machine for Pulping Turnips—L.2 to E. H. Bentall, Heybridge, Maldon, Essex. Second—The bronze medal to Samuel Corbett, Wellington, Salop.
50. Best Root-Washer—L.2 to the Trustees of W. Crosskill, Beverley. Second—The bronze medal to Richmond and Chandler, Salford.
51. Best Linseed-Bruiser for Hand-labour—L.2 to E. H. Bentall, Heybridge, Maldon, Essex. Second—The bronze medal to Richmond and Chandler, Salford.
52. Best Oil-Cake Bruiser for Hand-labour—L.2 to E. H. Bentall, Heybridge, Maldon, Essex. Second—The bronze medal to Richmond and Chandler, Salford.
53. Best Grain-Grinder or Bruiser for Power—L.5 to Picksley, Sims, and Co., Leigh, Lancashire. Second—The bronze medal to E. H. Bentall, Maldon, Essex.
54. Best Steaming Apparatus for Food—L.5 to A. and W. Smith and Co., Eglinton Engine Works, Glasgow. Second—The bronze medal to Richmond and Chandler, Salford.
55. Best Feeding-Troughs for Byres—L.1 to Patrick B. Mure Macredie, of Perceton, Kilmarnock. Second—The bronze medal to John Robson, Glasgow.
56. Best Feeding-Troughs for Sheep—L.1 to Wm. Kirkwood, Duddingston Mills, Portobello. Second—The bronze medal to Samuel Thomson, Blaiket, Crocketford, Dumfries.
57. Best Sheep-Fodder Rack—L.2 to William Kirkwood, Duddingston Mills, Portobello.
58. Best Churn worked by Hand—L.2 to Robert Tinkler, Penrith. Second—The bronze medal to Mrs Jane Beattie, Dumfries.
59. Best Churn worked by Power—L.3 to Robert Tinkler, Penrith. Second—The bronze medal to Philip Hunter, Edinburgh.
60. Best Cheese-Press—L.1 to Caldow and M'Kinnel, Dumfries. Second—The bronze medal to John Drummond, Cumnock.

61. Best General Set of Dairy Utensils—L.2 to Philip Hunter, Edinburgh. Second—The bronze medal to Henry Bridges, 406 Oxford Street, London.
62. Best One-horse Cart, with Harvest Frame—L.4 to Kemp, Murray, and Nicholson, Stirling. Second—The bronze medal to James Williamson, Camplebridge, Thornhill.
63. Best Harvest Cart—L.4 to James Williamson, Camplebridge, Thornhill. Second—The Bronze Medal to the Trustees of W. Crosskill, Beverley.
64. Best Light Spring-Cart—L.2 to the Trustees of W. Crosskill, Beverley. Second—The bronze medal to Robert Law, Shettleston, Glasgow.

Special.—Best Drag for the Common Cart—L.10 (given by Lord Ashburton), to Thomas M'Cririck, Cumnock.

65. Best Wheelbarrow of Malleable Iron—L.1 to William Kirkwood, Duddingston Mills, Portobello. Second—The bronze medal—*No award.*
66. Best Barrow for Conveying Cooked Food—L.1 to John Wingate, Alloa. Second—The bronze medal to Caldow and M'Kinnel, Dumfries.
67. Best Divisions, Rack, and Manger, for Farm Stables—L.2 to George Smith and Co., Glasgow. Second—The bronze medal to Adam Jack and Co., Glasgow.
68. Best Farm Harness—L.1 to Hay Downie, Corstorphine, Edinburgh. Second—The bronze medal—*No award.*
69. Best Stone or Iron Stack Pillars, with Framework—L.2 to John Robson, Glasgow. Second—The bronze medal to Caldow and M'Kinnel, Dumfries.
70. Best Field Gate, constructed entirely of Iron—L.1 to Bain, M'Nicol, and Young, Edinburgh. Second—The bronze medal to Thomas Perry and Son, Glasgow.
71. Best Field Gate, not constructed entirely of Iron—L.1 to Wm. Gillies and Son, Maxwelltown. Second—The bronze medal—*No award.*
72. Best Dunghill Gate, to open at different elevations—*No entry.*
73. Best Iron Hurdles for Cattle Fence—L 1 to Bain, M'Nicol, and Young, Edinburgh. Second—The bronze medal to John Hope and Son, Newton, Kirkpatrick-Fleming.
74. Best Iron Netting for Sheep Fence—L.1 to Bain, M'Nicol, and Young, Edinburgh. Second—The bronze medal to Bain, M'Nicol, and Young, Edinburgh.
75. Best Wooden Hurdles or other Fencing for Sheep—L.1 to Wm. Gillies and Son, Maxwelltown. Second—The bronze medal—*No award.*
76. Best Pipe or Tile Machine for Hand or Power—L.8 to E. Page and Co., Bedford. Second—The bronze medal to E. Page and Co., Bedford.
77. Best Glazed Pipes for conveying Water under pressure—L.3 to John Robson, Glasgow. Second—The bronze medal—*No award.*
78. Best Tiles and Pipes for Field-drainage—L.2 to John Robson, Glasgow. Second—The bronze medal to James Taylor, Moorfield, Kilmarnock.

79. Best Glazed Socketed Pipes for Sewerage—L.3 to John Robson, Glasgow. Second—The bronze medal to the Edmonstone Coal Company, Dalkeith.
80. Best Tools for cutting Field Drains—L.1 to Alexander Cadell, Cramond. Second—The bronze medal to Wm. Cotts, Shinnel Forge, Penpont.
81. Best Tools for cutting Open Drains in Hill Pastures—L.1 to Wm. Cotts, Shinnel Forge, Penpont. Second—The bronze medal to Alexander Cadell, Cramond.
82. Best General Set of Hand Implements for the Farm—*No entry.*
83. Best Gas Apparatus for Country-houses and Farm-steadings—L.5 to J. T. B. Porter and Co., Lincoln. Second—The bronze medal to J. T. B. Porter and Co., Lincoln.

EXTRA IMPLEMENTS, MACHINES, ETC.

The Judges commended—

Patent Corn Screen with Blower, belonging to R. Boby, Bury St Edmunds.

Six-Horse power Portable Steam-Engine, belonging to Caldow and M'Kinnel, Dumfries.

Steam-Engines, belonging to Alex. Chaplin and Co., Glasgow. (*Specially commended.*)

Pig Trough, belonging to Trustees of W. Crosskill, Beverley.

Grindstone, belonging to George Halkerston, Freuchie, Fifeshire.

Hand Stubble or Hay Rake, belonging to Wm. Kirkwood, Duddingston, Portobello.

Turnwrist, or Right and Left Plough, belonging to Thomas M'Cririck, Cumnock.

Curd-Crusher, belonging to Wm. M'Lachlan, Maxwelltown.

One-Horse Driving-Gear, belonging to Richmond and Chandler, Salford.

Portable Cooking-Range, belonging to Smith and Wellstood, Glasgow.

Collection of Saddlery, belonging to John Weir, Dumfries.

INSTRUCTIONS TO FARMERS ON THE READING OF ANALYSES, AND THE VALUATION OF MANURES.

By THOMAS ANDERSON, Professor of Chemistry in the University of Glasgow, and Chemist to the Society.

EVERY farmer must have experienced, to a greater or less extent, the difficulties and uncertainties attending the purchase of manures. The success of his cultivation, and, consequently, his pecuniary interests, are mainly dependent on the care and judgment he exercises in the selection of a substance capable of affording proper nutriment to his crops, and adapted to the soil on which it is used. So much, indeed, is this the case, that it may be laid down as a rule which, if not universally true, is certainly strictly applicable to the system of agriculture adopted in all our well-farmed districts, that what the farmer takes out of the soil is exactly proportionate to what he puts into it. So long as he relied exclusively, or almost exclusively, on farmyard manure, it was comparatively easy to secure the fulfilment of this requirement, because the substance employed contained all the elements of plants; and supposing it to be made and preserved with reasonable care, it did not differ very widely in composition and quality. In the preparation of farmyard manure the farmer conducts for his own behoof a manufacture which, when properly exercised, gives a nearly uniform product; and having thus the advantage of using always the same substance, he is enabled to watch all the different phases of its action, and to acquire a minute and extensive knowledge of the circumstances affecting its use. Long experience has taught the best methods of preparing and applying farmyard manure; indeed, almost all the precautions required for this purpose were known from a remote period; and the skilful farmer based his practice on the knowledge his predecessors had accumulated during a long succession of years—a knowledge which the teachings of science have extended and confirmed. It must be admitted, however, that though these precautions were well known to the good farmer, they were often but little attended to in practice, and over large districts of country carelessness and waste were the rule, and the proper management of manures the exception. And the reason for this is no doubt to be found in the fact that farmyard manure is accumulated in such a manner that there is no proper standard of value to which it can be referred.

The introduction of foreign and manufactured manures within the last fifteen or twenty years has, however, produced a change in this respect, which amounts almost to a revolution; and as these substances now form a far from inconsiderable part of the expen-

diture of the farm, it has become necessary to attend to their quality and value, so that a proper return may be secured for the outlay the farmer is compelled to make. The importance of attending to this point will be sufficiently obvious if we attempt to form some estimate of the sum annually expended by the British farmer on the purchase of artificial manures. It is impossible to do this with accuracy, because no means exist of obtaining an exact statement of the quantities of some of the substances used for agricultural purposes, but an estimate may be formed which approximates to the truth.

Where the substances are of foreign origin, and used exclusively for agricultural purposes, no difficulties are experienced; and we thus learn, from the Board of Trade returns, that the value of the guano imported into this country in the year 1858, and retained for home consumption, amounted to no less than £3,857,424. This sum, however, is considerably above the average, but it is probable that the usual import is not less than £2,500,000.

Next to guano the largest consumption is that of bones, of which, including bone ash, 84,000 tons are imported annually. In addition to this, however, it is necessary to take into account the bones collected in this country, of which it is only possible to form an approximate estimate. In Glasgow, there are collected about 6 tons 2 cwt. of bones for every 1000 of the population, and if this were the case all over the kingdom, the quantity would amount to upwards of 150,000 tons; but in country districts a considerable quantity of bones are lost, and the consumption of meat is also much smaller than in towns, and I do not think the quantity of bones collected can be safely estimated at more than 50,000 tons—giving, for the total quantity of bones used, 134,000 tons. A very large proportion of the bones collected in this country is converted into animal charcoal for the sugar refiners, but as the spent charcoal eventually finds its way into the hands of the manure manufacturer, it is not necessary to take this into consideration; but I estimate the quantity used in the manufacture of ivory black, for turning, &c., at 20,000 tons, leaving 114,000 to be employed in agriculture. Of this probably 40,000 tons are used as bone dust, costing the farmer £6 per ton, which is equal to £210,000, and 74,000 are converted, by the action of acid, into 110,000 tons of superphosphate, which, at £7 per ton, is worth £770,000.

The consumption of mineral phosphates, as far as I have been able to ascertain, is as follows:—

	Tons.
Cambridge coprolites, ...	40,000
Suffolk coprolites, ...	3,000
Apatite, and all other mineral phosphates, . .	5,000
	48,000

which, being entirely converted into superphosphates, will yield 72,000 tons, at £5, value £360,000.

Of nitrate of soda the average imports amount to 26,000 tons, of which about one-half—worth, at £15 per ton, £195,000—is used for agricultural purposes.

Of sulphate of ammonia it is difficult to obtain any definite information, but the opinion of persons conversant with the manufacture is, that about 6000 tons are used as manure, which, at £15 per ton, is worth £90,000.

If we add to this the sum of £50,000, as covering the value of the blood, fish-offal, animal matters of all kinds, potash, salts, &c. &c., used in the manufacture of manures, we have the following general statement:—

Guano,	£2,500,000
Bone dust, 40,000 tons, at £6,	240,000
Superphosphates, made from bones and bone ash, 110,000 tons, at £7,	770,000
Superphosphate from coprolites, 72,000 tons, at £5,	360,000
Nitrate of soda, 13,000 tons, at £15,	195,000
Sulphate of ammonia, 6000 tons, at £15,	90,000
All other substances, say,	50,000
	£4,205,000

It is probable that this estimate, so far from exaggerating the sum paid for artificial manures, falls considerably short of the truth. It will be observed that the prices assumed for the different articles are moderate, and considerably under those which the farmer is usually called upon to pay. It is also founded upon the assumption that all the manufactured manures are of good quality. Thus, for instance, it is taken for granted that a ton of bones yields 1½ tons of superphosphate, although practically this is often greatly exceeded. A large proportion of the bone ash imported into this country contains from 70 to 80 per cent of phosphates, but a superphosphate rarely contains more than 35 to 40 per cent, so that about 2 tons must be obtained from one of bone ash. The fact is, that the quantity is eked out by the addition of common salt, sawdust, and an endless variety of other substances: while positive adulteration both of superphosphates and guanos must also be taken into account. The extra sum paid by the farmers in this way cannot well be ascertained; but 10 per cent would probably be a very moderate estimate, to be added to the value already given. I have not done this, however, being unwilling to incur the charge of over estimating the sums actually paid.

It would be very interesting, were it possible, to ascertain what relation this large sum bears to the value of the farmyard manure annually consumed throughout the country; but on this point it is not easy to obtain any reliable information. A vague estimate

may perhaps be obtained from the number of acres of land under cultivation. It is said that the land under tillage on the British Islands exceeds 24,000,000 acres, and though this is probably above the mark, it may be adopted without much error.* If it be assumed that one-fourth of this is annually manured to the extent of 10 tons per acre with farmyard manure, the annual consumption must be 60,000,000 tons, worth about £20,000,000. It is probable that this estimate is too high, but it shows that at least one-fifth of all the manures now used is artificial, and chiefly derived from foreign sources.

The introduction of these new and important elements of fertility has not only altered the whole system of cultivation, but has placed the farmer in an entirely new position. It has not only opened up a wide field of inquiry into the use of manures, but has compelled him to exercise much vigilance in order to make sure that the substances he buys really possess the qualities he anticipates. Most of the artificial manures in use have a composition which is very variable, and altogether beyond his control; and even when any particular substance has given a satisfactory result, he is compelled, before he uses it again, to satisfy himself that the substance he buys under the same name really is identical with that from which his experience was derived. And herein lies one great difference between these substances and farmyard manure. The latter can always be recognised, and its quality and condition be tolerably well ascertained by ocular inspection; but with all other manures, the external appearance is no criterion of their quality, and it is possible to imitate their characters so nicely, that the worst appears equal to the best. To avoid the difficulties by which he is thus beset, the farmer is compelled to invoke the assistance of the chemist in order to ascertain that the manure he purchases really is what it is represented to be. But then arises the difficulty that the results must be expressed in the language of chemistry, which the farmer cannot be expected to understand minutely. It would be easy for him to obtain empirical information sufficient to enable him to read with understanding the analysis of a manure were it not for the numerous differences which are to be found in the mode of stating the results of their experiments, used by different chemists, which it is almost impossible for him to comprehend. The existence of those differences is greatly to be deplored, and it is most desirable that some general and uniform system should be adopted.

* The area under rotation of crops in Scotland and Ireland as ascertained by the agricultural statistics of 1857 is 9,416,661 acres, which falls considerably short of the quantity at which it had been previously estimated. The *estimated* area under tillage in England is 15,250,763 acres. It is probable that the collection of accurate statistics would show that this is considerably above the truth, as it has already done in the case of the old estimates for Scotland and Ireland.

As far as possible the most experienced chemists have adopted the same plan, or at least the differences are so slight as to be readily intelligible. But many circumstances have prevented it becoming universal, some individuals considering one system preferable to another, and many manufacturers seeking to support the individuality of their own manures by adhering to a form of analysis which distinguishes them from those of other makers. Another cause of difference is to be found in the gradual progress of our knowledge regarding the analysis of manures. Chemists are constantly at work verifying the methods in use, and introducing improvements calculated to make them more precise and afford a more definite idea of their commercial value. In point of fact, the methods employed for this purpose are of quite recent introduction; but they are the results of much careful consideration, and have been framed with the express intention of admitting of a fair comparison between different substances; and it is only necessary to contrast the minute and elaborate analyses made at the first introduction of guano with those now in use, to be convinced that the former, though scientifically accurate, are valueless as a means of establishing its commercial value, while the latter, just because they are less elaborate, afford a ready means of doing so.

But it must be borne in mind that, though the methods used may be the best and most suitable at any one time, it by no means follows that they are always to continue so, for new facts are discovered, and changes occur in the manufacture, which necessitate a change in the mode of expressing the analysis, so that the farmer cannot expect that the form is to be stereotyped, but must lay his account for alterations occurring from time to time, although the chemist will never adopt them until they are actually forced upon him, because he is well aware of the difficulties and inconveniences they entail.

In general, as has been already stated, the most experienced chemists adopt a nearly uniform method of expressing analyses; but on the other hand, it must be admitted that many, either through ignorance, or with the deliberate intention of misleading, are stated in such a manner as to be quite unintelligible even to the chemist. There is no difficulty, however, in forming an opinion as to the degree of reliance to be placed on any analysis, and rules can be laid down, which, in most instances, will enable the farmer to do this for himself, and which it is the object of these pages to explain. For this purpose it is necessary to enter into some details regarding the nature and composition of the most important manures.

At the outset it must be laid down as a rule that the more simply the analysis of a manure can be expressed the better. The object of the analysis being to enable the farmer to effect a comparison between different samples, and ascertain which is the best,

it ought to be framed with this view. It is not only unnecessary, but undesirable, that extreme scientific minuteness should be aimed at. On the contrary, the different constituents should, as far as consistent with chemical accuracy, be arranged under several great heads. Thus, for example, a guano generally contains phosphate of lime, phosphate of magnesia, and sometimes a small quantity of phosphate of iron ; but it would serve no good purpose to state the quantity of those substances separately, because, as they have all precisely the same value, the first step taken by any person anxious to estimate the proper price of the manure would be to add them all together. The fact is, that the separate statement of these constituents in the analysis of a manure, would rather excite the suspicion of the experienced chemist, because he knows that their accurate separation is a most elaborate and difficult process, which could not be performed for the fee usually paid for such analyses, and he would conclude that it was a pretended and not real accuracy. The careful chemist concentrates his attention on the accurate determination of the sum of these substances, which are stated under the general head of phosphates, and a similar plan is adopted with the other components, so that the different constituents are reduced to a small number of easily comparable heads, which will be readily made intelligible when we speak of individual manures. The analyst endeavours as far as possible to avoid adding to the number of those heads unnecessarily although of course cases occur in which this is indispensable, and he is then careful to explain the nature of the difference, and the reason for deviating from the usual system.

In discussing the details of analysis, and the points to which it is necessary for the farmer to attend, we may in the mean time exclude from our consideration such substances as nitrate of soda and sulphate of ammonia, and restrict ourselves to the two great classes of guano and superphosphates, to which nine-tenths of those now in use may be referred. Guanos are all substances of natural origin ; and almost all manufactured manures, though sometimes called artificial guanos, or designated by other names, are substantially superphosphates. Directing attention, in the first instance, to Peruvian guano, the most extensively used variety of its class, its analysis is generally expressed in the following manner :—

Water,	13.73
Organic matter and ammoniacal salts,	53.16
Phosphates,	23.48
Alkaline salts,	7.97
Sand,	1.66
	100.00
Ammonia,	17.00
Phosphoric acid in alkaline salts, equal to 5.42 phosphate of lime,	2.50

Occasionally the method given below is adopted :—

Water,	13.73
Organic matter,	53.16
Phosphates of lime,	23.48
Phosphoric acid,	2.50
Alkaline salts,	5.47
Sand,	1.66
	100.00
Nitrogen,	14.00
Equal to ammonia,	17.00
Phosphate of lime insoluble,	23.48
Phosphate of lime soluble,	5.42

The latter method presents no advantages over the former, but is more complicated, which is a disadvantage. Thus, it is unnecessary to give nitrogen when ammonia is stated; and the head called alkaline salts, which is obtained by deducting the phosphoric acid from what is so called in the first system, is really a mixture of alkaline salts with the alkalies from which the phosphoric acid has been withdrawn.

In examining the analysis of a Peruvian guano, it is to be noticed that, like all other manures, it is a mixture of valuable and worthless matters. Water and sand of course belong to the latter category, and they only merit consideration in those cases in which they are so abundant as to reduce the proportion of other matters. The quantity of water is so far of importance that it indicates the condition of the manure, and shows that it has not been damaged, and is sufficiently pulverulent to admit of its easy application. Provided, however, the valuable matters are not below the average, the quantity of water and sand is a matter of comparatively little moment. Turning to the valuable matters, we see that in a genuine Peruvian guano, more than half its weight consists of organic matter and ammoniacal salts, containing 17 per cent of ammonia; somewhat less than $\frac{1}{4}$ is composed of phosphates insoluble in water, and in a form similar to that in which they exist in bones. One-tenth is alkaline salts, containing 2.5 per cent of phosphoric acid, which is soluble in water, and in a condition analogous to that in which it is found in the soluble phosphates of a superphosphate. If any constituents appear in the analysis besides those just enumerated, and if the sand is large, the guano is certainly not genuine. As regards the individual constituents of a guano, it is to be observed, as will be afterwards pointed out, that their value differs very greatly, and hence variations in the proportion of some are of much greater importance than others. It must be borne in mind that $\frac{3}{4}$ of the value of a Peruvian guano is due to ammonia, $\frac{1}{8}$ to phosphates, $\frac{1}{8}$ to phosphoric acid in the alkaline salts, $\frac{1}{50}$ to organic matter, and only about $\frac{1}{150}$ to alkaline salts. It will be obvious, therefore, that the two latter are of little moment in judging of

the value of any sample, and that they may for all rough estimates be entirely disregarded.

Whenever the farmer has occasion to examine the analysis of a Peruvian guano, with the view of ascertaining whether it is one which he ought to purchase, his attention should in the first instance be directed to the quantity of ammonia, because even a small diminution in that substance has a marked influence on the price of the manure. The reduction in value caused by the ammonia being 1 per cent under the average, could only be counterbalanced by an excess of 8 per cent of phosphates, and by a proportionate quantity of other constituents. Of course, Peruvian guanos differ somewhat from the average given above, although it is commonly supposed that the variations are so slight that, provided it be ascertained to be genuine, its analysis is unimportant. No doubt the importers encourage this view by charging the same price for all cargoes of guano, altogether irrespective of analysis; but, nevertheless, there are very material differences, especially in the amount of ammonia, and samples are sometimes met with containing as little as 15, and others as much as 19 per cent of that element, involving a difference in value amounting to nearly £2, 10s. per ton. Such differences, of course, can only be detected by complete analysis; but if it is merely desired to ascertain whether or not a sample is genuine, without determining its exact value, it is possible to arrive at this information by means of a partial analysis, such as the following, the relations of which to the complete analysis already given will be seen at a glance:—

Water, organic matter, and ammoniacal salts, .	66.89
Phosphates, ...	23.48
Ammonia, ...	17.00

In this case, the main constituents being right, it may be fairly assumed that the others will not differ materially from the average; sometimes even this may be dispensed with, and the experienced chemist is able, by the application of simple tests, to determine whether or not a sample is unadulterated, although he cannot in this way give any estimate of the relative values of two genuine specimens.

Hitherto the general run of Peruvian guanos, though varying considerably in quality, have been remarkably free from sand and other foreign matters; and, when directly imported, analysis has been less important than with other manures, the more especially as differences in quality are not recognised as modifying the price. It is probable, however, that greater attention will require to be paid to this point in future. A case has recently occurred in which a cargo of guano, said to be unquestionably a direct importation from the Chincha Islands, was found to contain in some parts as much as 18 per cent of sand, and only 11 or 12 of ammonia.

Should this cargo prove to be in the state in which it left the islands, then much greater vigilance will be necessary, and no one will in future purchase a Peruvian guano without analysis. The investigation into the case now referred to is not yet complete; but there is little doubt about the fact, and there is even good reason to suspect that several similar cargoes have been imported. Notwithstanding these differences, however, it must be admitted that Peruvian guano is distinguished from all the other varieties of that manure by a certain degree of uniformity, so that, assuming it to be genuine, the chances are that the purchaser receives value for his money. But the case is very different with the other kinds of guano. These differ not only in composition from Peruvian guano, but are obtained in most instances from small and shallow deposits, so that different cargoes, and even different parts of the same cargo, differ to an extraordinary extent. The farmer, therefore, can place no reliance on their uniformity, but every cargo requires to be separately examined. Still less can he rely upon the name given them. In talking of Peruvian guano, we mean the guano brought from one single deposit, that of the Chincha Islands. But Chilian, Patagonian, and Bolivian are names applied to manures found at different places along the coast of these countries, often several hundred miles apart, and which have not the slightest resemblance in composition. All other guanos are distinguished from Peruvian by the much smaller quantity of ammonia they contain. That variety, owing to its having been deposited in the small zone in which rain never falls, retains almost undiminished the nitrogenous constituents existing in the dung of the bird; but in all other localities rain has produced a greater or less effect upon the manure, causing the more or less complete decomposition of the organic nitrogenous parts, which is washed out, along with the soluble mineral matters; and it is possible to have in the samples from different localities the gradual passage from guanos like Peruvian, rich in ammonia, until we arrive at those which have been so long and thoroughly exposed to the weather that little more than traces of that substance remain. In consequence of the removal of these elements, the phosphates have come to be the largest and most important constituent of these varieties, which are commonly distinguished as phosphatic guanos. But the difference does not stop here; not only do these guanos often contain a considerable quantity of sand, due no doubt in part to the subjacent sand being lifted along with it when it occurs in thin layers, but they often contain carbonate and sulphate of lime, and sometimes oxide of iron. The mode in which these substances find their way into these guanos is not well understood, because the localities have never been examined by scientific men; but they are not adulterations—that is to say, they have not been deliberately added to the guanos, although of course they necessarily diminish their value.

The composition of guanos other than Peruvian is so variable, that any attempt to discuss the particular composition of individual varieties would be attended with little advantage. The following are average analyses of some of the more familiar kinds:—

	Bolivian.	Saldanha Bay.	Kooria Mooria.	Patagonian.	Chilian.
Water,	16.44	21.03	8.91	20.61	14.89
Organic matter and ammoniacal salts,	13.28	14.93	7.72	19.72	16.83
Phosphates,	56.09	56.40	44.15	30.66	36.90
Sulphate of lime,	...	...	3.19	1.30	...
Carbonate of lime,	...	...	3.37	3.66	10.28
Alkaline salts,	11.38	6.10	11.23	7.01	6.84
Sand,	2.81	1.54	21.43	17.04	14.26
	100.00	100.00	100.00	100.00	100.00
Ammonia,	2.57	1.62	0.42	2.1	1.42
Phosphoric acid in the alkaline salts,	3.11	...	...	3.00	...

But, to show how little reliance is to be placed on the uniformity of these descriptions, we may add analyses of several samples of Bolivian guano, all of which were undoubtedly genuine,—that is to say, were in the condition in which they had been imported:—

	I.	II.	III.	IV.
Water,	4.25	19.70	11.80	7.20
Organic matter and ammoniacal salts,	10.50	15.65	18.65	11.25
Phosphates,	58.84	16.10	12.80	13.31
Sulphate of lime,	...	40.93	32.91	7.40
Alkaline salts,	2.26	4.97	5.94	58.84
Sand,	24.15	2.65	17.90	2.00
	100.00	100.00	100.00	100.00
Ammonia,	0.80	0.37	0.46	2.04

These analyses are made out on exactly the same principle as those of the Peruvian, and they are also read in a similar manner, reference being made to the worthless substances which now, in addition to sand and water, may consist to a large extent of sulphate or carbonate of lime. The principal attention, however, should be directed to the quantity of phosphates; and it is necessary to bear in mind that in guanos of this description, from a half to five-sixths in their value depends upon the quantity of phosphates they contain; while the ammonia, especially in guanos like Saldanha Bay, Patagonian, Chilian, &c., is comparatively unimportant.

Little difference is found in the mode of expressing the analyses of guanos, almost all chemists being agreed as to the system to be employed; and such differences as do occur cannot occasion any difficulty. It sometimes happens, however, that analyses are seen with such items as phosphate and carbonate of lime, sulphates of lime, potash, and soda. All analyses containing such heterogeneous items should be unhesitatingly rejected, as they are entirely worthless, and in place of affording the means of forming an esti-

mate of the value of the manure, are only calculated to mislead and confuse the purchaser.

In the analysis of superphosphates, many important questions present themselves for consideration, dependent on the fact that they are manufactured manures, and that their composition depends to a great extent on the nature of the materials employed in making them. It will be understood that the term superphosphate was originally applied to a mixture of common bones and sulphuric acid, and therefore strictly merited the name of dissolved bones originally applied to it. The introduction of coprolites, and more recently of apatite and various other phosphates, has rendered the wider designation necessary. The use of these substances has also entailed further differences in the mode of manufacture, sulphate of ammonia, flesh, fish-offal, and various other animal substances being used to supply the nitrogen in which these materials are deficient; and the consequence is that the greatest possible difference exists in the composition of this manure, so much so that the product of no two manufactories is exactly alike, and very often, owing to variations in the quality and quantity of the different raw materials, dictated of course by economic considerations, samples obtained at different times from the same manufacturer show a remarkable want of uniformity. The difficulty of understanding the analysis is necessarily enhanced by these differences, and still more by the discrepancies which exist in the mode of stating the results used by different individuals, which are very great, and sometimes the cause of much misapprehension.

In order to render the analysis of a superphosphate intelligible, it is necessary to explain that in bones and all other similar substances the phosphoric acid is in combination with lime, and the compound is entirely insoluble. But there exists another compound of these substances, containing only one-third of the lime existing in the bone earth phosphate, which is exceedingly soluble in water, and is commonly known by the name of biphosphate of lime. When, therefore, two-thirds of the lime are removed from the former compound it is converted into the latter, and this is effected by means of sulphuric acid, which, by its superior attraction for lime, withdraws it from the phosphoric acid, and forms with it a quantity of sulphate of lime or gypsum. It is found also by actual experiment that 100 parts of the ordinary bone phosphate of lime contain 46 of phosphoric acid, which, by removal of the lime, is converted into 64 parts of biphosphate of lime, still containing all the phosphoric acid, the difference in weight being due to the abstraction of the valueless lime, which, along with sulphuric acid, has produced 110 parts of gypsum. By the addition of a proper proportion of acid to bones or any other raw material, the whole of the phosphates might be converted into this compound, but practically great difficulties are encountered in doing so, and in the case of raw bones

it cannot be accomplished. Nor is this a matter of much moment, because experience has shown that it is not desirable to do so, but that it is preferable to have a proportion of the phosphates in their original insoluble state. It will be understood from what has been said, that in the act of making the phosphoric acid soluble a quantity of sulphate of lime is produced, and it is important to notice this point, because it is very commonly believed by farmers that the sulphate of lime, which forms so large a constituent of all superphosphates, is deliberately added to them by the manufacturer. This, however, is a mistake. Sulphate of lime is very rarely added to a superphosphate, the efforts of the manufacturer being devoted to keeping it down as much as possible, because it is well known that a large proportion of it excites suspicion and distrust on the part of the farmer. The fact is, that it is impossible to obtain any given quantity of biphosphate of lime without at the same time producing 1½ times as much gypsum, but in practice the proportion is generally much larger than this, because almost all the raw materials employed in the manufacture contain a considerable quantity of carbonate of lime or chalk, which by the action of the acid is also converted into sulphate. This is particularly the case with coprolites, and the consequence is that it is far from uncommon to find the gypsum two or three times as large as the biphosphate.

The analysis of a superphosphate is usually and most correctly stated in the following manner:—

Water,	18.39
Organic matter,	14 11
Biphosphate of lime, equivalent to 14.88 soluble phosphates,	9.53
Insoluble phosphates,	15.13
Sulphate of lime,	33.42
Alkaline salts,	3.82
Sand,	5.60
	100.00
Ammonia,	2.10

But another method is sometimes used, which is given below, for the same sample:—

Water,	18.39
Organic matter,	14.11
Soluble phosphates,	14.88
Insoluble phosphates,	15.13
Sulphuric acid,	7.63
Sulphate of lime,	20 44
Alkaline salts,	3.82
Sand,	5.60
	100.00
Ammonia,	2.10

The difference between the two is sufficiently obvious. It will

be observed that in the last biphosphate of lime does not appear, but that soluble phosphates only are stated, while the sulphate of lime is much diminished, and sulphuric acid is given in the free or uncombined state. This method expresses the fact that the mixture used in the manufacture of the manure contained a certain quantity of phosphates, of which one portion remained in its original insoluble state, while the other was rendered soluble by the action of the 7.63 per cent of acid. Hence, according to the last method, the analysis is stated so as to represent the materials employed, in the condition in which they existed at the moment of mixture, but indicating under a separate head the quantity of phosphates about to become soluble, and the quantity of acid destined to produce that change; while by the first system, the results are arranged so as to express the state of matters after the chemical action has taken place. For this reason no sulphuric acid appears in the analysis as such, for it is given in combination with the lime which it has removed from the soluble phosphates, and consequently makes the quantity of sulphate of lime appear much larger than the old method.

It is to be noticed that the actual experimental results are the same whichever mode of stating the analysis be adopted, neither is there any difference in the valuation of the manure, but it is obvious that the first method is most consistent with the principles usually acted on by chemists. The last, however, is preferred by manufacturers, who allege that their customers understand it better; but the real reason for the preference is, that soluble phosphates show more largely in the analysis, while the sulphate of lime appears smaller, and sulphuric acid, which the farmer knows costs money, is shown as such. It is right, therefore, that it should be distinctly understood that in the manure the sulphuric acid used as a solvent is combined with lime and is not in the free state, so that the first method gives the actual quantity of sulphate of lime present.

Of course, if any of the heads under which the analysis of a superphosphate is expressed differ from those above given, caution is to be exercised, and when any heterogeneous items, such as sulphate of lime and alkalies, or sulphate of lime and sulphuric acid, are stated, the analysis ought to be rejected. It is customary, in some instances, for analyses to be published in which the ammonia is not stated separately, but is given thus—

"Ammonia equivalent to 8.76 sulphate of ammonia."

This is objectionable, and no analysis should be accepted which does not give distinctly the exact quantity of ammonia itself. The reason for doing so is, that the ammonia is the substance determined by experiment, and the quantity of sulphate is calculated from it; and, as sulphate of ammonia contains 25.75 of ammonia, hence,

if the chemist finds say 3 per cent of ammonia in a manure, he calculates the sulphate by the rule of three, thus—

25.75 : 100 :: 3 : 11.64 sulphate of ammonia.

But there are some persons who hold by an old analysis of sulphate of ammonia, which has long since been shown to be erroneous, that that substance contains only 22.66 per cent of ammonia; and they, of course, calculate thus—

22.66 : 100 :: 3 : 13.23 sulphate of ammonia;

and hence, if the quantity of ammonia be suppressed, the analysis shows about 2 per cent more sulphate than it ought. The manufacturer also likes to have the sulphate of ammonia given, as it is a dear form in which to purchase ammonia, because that substance, as we shall afterwards see, is usually valued at £60 per ton in manures, while in sulphate of ammonia it is sold considerably dearer, and has sometimes been as high as £70, and even £80 per ton.

There is another matter connected with the analysis of a superphosphate to which it is necessary to call the attention of the farmer, because, though a strictly technical matter, it is of much importance that he should be aware of it, and this is the extent to which inaccuracy prevails in the determination of the soluble phosphates, which is a difficult process, requiring particular precautions in order to secure precise results. Much attention has been paid to the subject by chemists, and it has been clearly shown that the method most commonly used for the purpose is exceedingly erroneous. It must be explained that this process consists in adding to the solution of the superphosphate, first a quantity of a salt of lime, and then ammonia, and the precipitate so obtained is weighed and estimated as "soluble phosphates." But this process greatly exaggerates the quantity of that important constituent of the manure, because part of the lime added is carried down along with the "soluble phosphates," and is weighed and reckoned in the analysis as if it were phosphates and not lime. The extent of the error produced in this way may be best shown by a practical illustration. I took a superphosphate, and, determining the quantity of soluble phosphates by the erroneous method just described, I found it to amount to 37.29 per cent, but when I used an accurate process it was found that the real per-centage was only 29.12, thus showing a difference of 8 per cent, which, as we shall afterwards see, is equivalent to about £2, 8s. per ton in the value of the manure. In this case the error is very large, but it is generally as much as 4 or 5 per cent, and always gives an excess, so that the manure appears better than it actually is. This erroneous method, I am sorry to say, is persisted in by a number of analysts, and their reason for adhering to it is, that it is an easy and expeditious process, and by using it the analysis of a superphosphate does not require the same amount of time and

skill which are necessary for the more accurate method; and as the fees for the analysis are unremunerative, there is too much inducement to use quick and superficial processes. Unfortunately there is nothing in the analysis itself which shows whether the accurate or inaccurate process has been used, and the farmer must ascertain this indirectly. The difference, though little known to the farmer, is familiar to many manufacturers and dealers, and that to such an extent, that when purchasing they take care to do so by the analysis of the accurate chemist, but when selling to the farmer they publish the analysis of some one who uses the fallacious process, because it makes the manure appear better than it really is.

In judging of the quality of a superphosphate, the first point is to ascertain whether it is made from bones or from bone-ash, or other materials not containing organic matters. It is very difficult to do this with certainty, because the practice among manufacturers is in most cases not to use exclusively one kind of material, but to mix several together. In fact, bones are comparatively rarely used alone, but are mixed with bone-ash, or, when a cheap manure is to be made, with coprolites, by which means a good dry and pulverulent article is more easily produced. A superphosphate made from bones alone has generally a brown or black colour, and when beaten in a mortar or between stones, is found to be very pasty in its consistence. This is not necessarily due to excess of moisture, but to the gelatinous matters of the bones, which, with the water and acid, acquire the consistence of moist glue. A superphosphate made from bone-ash, on the other hand, when well manufactured, has a grey colour, and is very dry and pulverulent in appearance, even though it may contain more moisture than a sample made from bones. In general, superphosphates are made from mixed materials, and where bone-ash or coprolites are used, sulphate of ammonia, blood, or other similar substances, are used to supply ammonia; and as the kind and proportion of those materials are varied to an endless extent, the farmer, unless he has a large experience of manures, can rarely form a satisfactory opinion from its external appearance.

In reading the analysis of a superphosphate, attention must, in the first instance, be directed to the quantity of biphosphate of lime, which constitutes from two-thirds to three-fourths of the value of the manure when made from bones. Of the other constituents, about one-sixth is due to ammonia, and one-seventh to the insoluble phosphates, the remainder going to organic matter and sulphate of lime. If the superphosphate is made from bone-ash or coprolites, in which case the analysis will show no ammonia, or only a small fraction of a per cent, from four-fifths to in some cases as much as nine-tenths of the value is due to biphosphate of lime, and in some instances all the other constituents may be

practically neglected, and the proportion of that substance alone be made the basis of valuation.

In selecting a superphosphate, it is important to consider the particular use to which it is to be put. If employed alone, it will generally be found best to choose those made from bones, or at least those containing ammonia, and in that case there should not be less than 10 per cent of biphosphate of lime—equivalent, in round numbers, to 15 of soluble phosphates, 15 of insoluble phosphates, and about 2 of ammonia. If, on the other hand, the manure is to be employed along with Peruvian guano, it is in general more economical to take one made from bone-ash, and in that case there ought to be at least 16 per cent of biphosphate—equivalent to 24 of soluble phosphates, and 8 or 10 per cent of insoluble phosphates.

A variety of superphosphates are sold under such names as British Guano, Concentrated Manure, &c. &c., which are made from bones or bone-ash, mixed with salts of ammonia and other substances; all these are to be estimated and judged of in the manner just described.

Nothing is easier than to read the analysis of sulphate of ammonia or nitrate of soda; all that is necessary is to look to the per-centage of these substances. A good sample of sulphate of ammonia ought to contain from 96 to 98 per cent of actual sulphate, containing about 25 of actual ammonia, and from 2 to 4 of impurities. If the quantity much exceeds this, the quality is inferior, and if the "fixed residue" is large, the sample may be looked upon as adulterated. Nitrate of soda ought to contain about 95 per cent of the salt, and about 5 of impurities; but if it contain less than 90 per cent of the nitrate it ought to be rejected. It is right that the farmer should know that the merchant always sells nitrate of soda by the per-centage of nitrate it contains, and that he ought to obtain it from the dealer on the same terms, although, I believe, this is not usually attended to by the retailers.

As far as other manures, such as manufacturing refuse and the like, are concerned, no general rule can be given for judging of their quality, as they are extremely variable in composition. In general, however, it may be laid down as a rule that their value is not high, and that the prices at which they are sold are not unfrequently above what their composition justifies.

Supposing the farmer to have examined the manure he proposes to purchase, and to have obtained an accurate analysis, the next point is to ascertain its value. The best method of doing this is a practical problem of much importance, which has attracted the attention of many persons, and several plans, differing in detail though similar in principle, have been suggested. The difficulty which attends the contrivance of a system which shall be altogether beyond cavil, and obtain the concurrence of every one, lies in the

complex nature of most manures, and the number of different factors of which their value is made up. In the case of a substance such as sulphate of ammonia or nitrate of soda, which owes its value to one ingredient having a definite market price, the value of different samples is easily and clearly ascertained, and the deduction to be made for any given amount of impurity is estimated in a manner which requires no explanation. But when a substance is of complex constitution, and contains several different constituents which all go to make up its value, it is necessary to have a separate estimate for each of these, which must be deduced from the price, not of this particular complex mixture, but from that of other substances in which each of the valuable constituents is met with separately. Now, it so happens that the commercial value of different substances is not estimated solely by considerations of composition, but questions of demand and supply and applicability to various purposes have an important influence. Thus, for example, a coprolite containing about 60 per cent of phosphates sells for £2, 10s. a ton, while a purely phosphatic guano containing the same quantity brings from £6, 10s. to £7, 10s.; in other words, the phosphates in such a guano bring more than twice the price they would do in coprolites; and the reason is obvious: in the one case they are in a condition which admits of their direct application to the soil, while in the other they must first undergo an expensive preparation. In the same way, by inquiring into the price of bone-ash, the value of the phosphates contained in them is found to be intermediate between that of coprolites and guano; nay, if we go further, and take the market price of different kinds of guano, we find that the rates at which the phosphates are sold differ to a very extraordinary extent. This is due in part to the fact that the price charged for any article is estimated commercially at such a rate as to cover the expense of freight and other charges, and to leave a profit to the dealer—a price which it is to be assumed that the purchaser will not pay unless he, on the other hand, has satisfied himself that he can clear a profit from the transaction—and partly, also, to the carelessness with which manures are often purchased, and the want of careful comparison of the relative profits derived from different substances. The state of division of the substance—the extent to which its different constituents are available to the plant—the facility with which it can be applied to the soil, &c., also exert an influence on the price. These considerations are of great importance where many different substances are compared, but they are not likely to be of much moment in the case of strictly analogous substances—such, for example, as two different kinds of guano belonging to the same class; and it must be admitted that in these cases no good ground for the difference in the prices given

can be shown, and it would in all probability disappear if more attention were paid to the results obtained in the field.

The more minutely the subject is inquired into, the more obvious does it become that no system of valuation can be made perfectly general, but that each individual kind of manure requires a plan suited to itself alone. This, however, involves such difficulties and complications that an attempt has been made to form a general system, which, though not absolutely correct, is a sufficient approximation, and at least a satisfactory guide to the relative values of these substances.

In purchasing a manure, the substances which are of actual value are ammonia, insoluble phosphates, biphosphate of lime (soluble phosphates), sulphate of lime, nitric acid (as nitrate of soda), potash, soda, and organic matter. These different substances differ greatly in value. Ammonia and the phosphates, soluble and insoluble, are costly, and by far the greater part of the value of all the common manufactured manures depends on them. Potash also sells at a high price, but it is rarely found in manures, and never in sufficient quantity to exert any important influence on their price, and it is not customary to take it into consideration except in particular cases. The alkali most commonly found in artificial manures is soda, and when alkaline salts are stated in an analysis, they must be assumed to consist almost entirely of that substance, and be valued accordingly. Sulphate of lime and organic matter, though abundant constituents of most manures, add but little to their value, and some persons do not include them in their estimate, although the more common practice is to make allowance for them.

In order to obtain a fair value for each of these substances, it is necessary to ascertain the commercial prices of each separately. This, however, cannot be done directly in all cases, and it is necessary sometimes to arrive at it by an indirect process, in the manner which will be afterwards explained. The question to be solved is the price actually paid for a ton of each of these substances in a pure state, and we shall consider each in succession.

Insoluble phosphates are purchased in several different forms. Coprolites ground to a fine powder and containing 58 per cent of phosphates sell at £2, 12s. per ton, and a ton of pure phosphates is consequently sold for £4, 8s. In this state, however, the price is extremely low, because it is alleged that the phosphates are in so compact a condition that the plant cannot avail itself of them, and they are only used as a raw material for the manufacture of superphosphates. Bone-ash, containing 70 per cent phosphates, costs £4, 10s. per ton, and pure phosphates in this form are therefore sold at £6, 8s. These are the principal forms in which phosphates are sold alone, but it is possible to calculate the value they

bear in bones by deducting that of the ammonia they yield from their price, and assuming the remainder to represent the price paid for the phosphates; a similar course may be adopted with phosphatic guanos, and a ton of insoluble phosphates is thus found to be worth in—

Coprolites, ...	£4	10	0
Bone-ash, ...	6	8	0
Bones, ...	7	5	0
Phosphatic guanos, ...	10	0	0

These are the actual market prices, and it is important to notice the very great extent to which they differ—the farmer who purchases a phosphatic guano paying for the phosphates much more than he could obtain them for in other forms—a difference which can only be attributed to the higher state of division in which they exist in the guano, and their consequent accessibility to the plant. We are compelled, therefore, to estimate the value of phosphates in such guanos at this price, although in an ammoniacal guano, such as Peruvian, they are sold at a lower rate; but for all other manures, of which bones and bone-ash form the basis, £7 per ton may be taken as a fair rate, and it is that which has been usually adopted, although £8 and even £10 are sometimes assumed as the general price.

Ammonia is found, in commerce, in the shape of sulphate of ammonia, which at present sells at from £15 to £15, 10s. per ton; and, making allowance for the ordinary amount of impurity (5 or 6 per cent), the price of ammonia in this form is about £63 per ton. By calculating from the price of other substances, it appears that the following are the values of ammonia per ton, in—

Sulphate of ammonia,*	£63	0	0
Bones, ...	61	0	0
Peruvian guano, ...	57	0	0

The general average being £60 per ton, which is the price usually adopted.

Sulphate of lime sells for about £1 per ton, and this value is accordingly always adopted.

Considerable doubt exists as to the propriety of allowing any value for the organic matters in manures, because it is supplied in farm-yard manure in so large quantity as to make the few pounds contained in an ordinary dressing of artificial manure unimportant. It is customary, however, to state it from 10s. to £1 per ton; and, from various considerations, into the details of which it is unnecessary to enter, I prefer the lower estimate.

Alkaline salts, consisting chiefly of soda, are taken at £1 per

* The price of sulphate of ammonia is at present very low. It has frequently been as high as £17 and even £18 per ton, at which rates ammonia is sold at from £68 to £72 per ton,

ton; and potash at from £20 to £30—the former being the price at which it can be procured in kelp.

Nitrate of soda is at present sold at about £14 per ton; but if allowance be made for impurities, and the average price adopted, the cost of the pure salt is about £16.

Considerable difficulty attends the estimation of the value of soluble phosphates, because they are not met with in commerce alone, or in any form except that of superphosphates, and the price at which they are sold in different varieties of that manure and by different manufacturers, varies very greatly. The only course open to us is to endeavour to determine the average price and composition of good superphosphates, and, putting the values already determined on all the other constituents, to reckon the difference between that sum and the market price as the value of the soluble phosphates. If we throw out as inferior samples all those containing less than 10 per cent of soluble phosphates, and take the good only, the average composition of the superphosphates in the market during the present year has been—

Water,	10.71
Organic matter,	9.33
Biphosphate of lime, equivalent to 19.43 soluble phosphates,	12.45
Insoluble phosphates,	14.78
Sulphates of lime,	45.24
Alkaline salts,	2.11
Sand,	5.38
	100.00
Ammonia,	1.71

It is more difficult to determine the average price at which the manure is sold, for those analysed included samples at all prices from £7 per ton up to £10, and in some cases even £10, 10s.; but on the whole it may be assumed that the average price is about £8, and if so, soluble phosphates are sold at £27, 19s. per ton. Had the inferior samples been included so as to give a general average, the price would have been still higher. The usual price at which soluble phosphates—that is, bone phosphate made soluble—are estimated, is £30 per ton, and £46, 16s. for biphosphate of lime, although occasionally the former has been reckoned as low as £25, with a corresponding rate for the latter.

All these prices are liable to fluctuation according to the state of the market, and they ought to be varied at different times; but it is obviously impossible for the farmer to watch the changes of price so as to do this, and it is much more convenient and safer to adopt a fixed average which can be used for the comparison of different manures. Indeed, if absolute precision were to be aimed at, it would be necessary to vary these estimates in different localities, and to some extent also according to the kind of manure.

This is particularly the case in regard to the price of soluble phosphates, which is actually fixed by the manufacturers of superphosphate, and in this respect very remarkable differences are observed; for in samples made from pure bones it is by no means uncommon to find the soluble phosphates sold as high as £40 per ton, while in those made from bone-ash and acid their price sometimes does not exceed £20. In the same way insoluble phosphates, which in bones and bone-ash are sold for about £7 per ton, cost £10 in phosphatic guanos, so that a different value must be established for these substances in their different conditions. It may, indeed, be alleged that no such difference is admissible, and that the lowest price should in all cases be assumed as the basis of calculation, but, on the other hand, it must be remembered that the whole object of adopting a system of valuation at all is for the purpose of obtaining a fair estimate of the market price of the article, and the values used when applied to an average sample ought to bring out the average price. Hence, when a farmer buys a phosphatic guano at a price which gives £10 per ton for the phosphates, we are not entitled to say that he has paid too dear, and that he ought to have got them at £7 per ton, the rate at which they are purchased in bones. On the contrary, we are bound to assume that he would not have paid this price for them unless he found it to his advantage, and to make it the basis of the valuation.

It is sufficiently obvious that the values of the different substances contained in manures being a matter of deduction, considerable differences must exist in the values attached to them by different individuals, and we therefore give a table showing the values per ton as adopted by different analysts:—

	Way.		Voelcker.		Nesbit.		Hodges.		Anderson.	
	£	s.	£	s.	£	s.	£	s.	£	s.
Ammonia,	56	0	60	0	60	0	56	0	60	0
Insoluble phosphates,	7	0	10	0	8	0	7	0	7	0
Do. in phosphatic guanos,	7	0	10	0	8	0	7	0	10	0
Soluble phosphates,	32	13	30	0	24	0	25	0	30	0
Biphosphate of lime,	50	3	46	16	37	8	39	0	46	16
Alkaline salts,	1	0	1	5	1	0	1	0	1	0
Sulphate of lime,	1	0	1	5	1	0	1	0	1	0
Potash,	30	16	—		—		20	0	20	0
Nitrate of soda,	—		20	0	—		—		16	0
Organic matter,	1	0	1	0	1	0	0	10	0	10

The practical application of these values is very simple, and will be readily understood by a few examples. Selecting, in the first instance, the superphosphate of which the analysis has been given on a previous page, it is at once obvious, that if we propose to purchase 100 tons of the manure, the percentages will represent

the number of tons of each ingredient in that quantity, and the value is calculated in the following manner:—

14.11	Tons	of organic matter at 10s. per ton, . .	£7
14.88	„	soluble phosphates at £30 per ton, .	446
15.13	„	insoluble phosphates at £7 per ton, .	105
39.43	„	sulphate of lime at £1 per ton, . .	39
3.82	„	alkaline salts at £1 per ton, . .	4
2.10	„	ammonia at £60 per ton, . .	126
		Value of 100 tons, . .	£727

Hence dividing this sum by 100 we obtain £7, 5s. as the value of one ton.

An average Peruvian guano, calculated in the same manner, gives—

53.16	Tons	of organic matter at 10s. per ton, . .	£26
23.48	„	insoluble phosphates at £7 per ton, .	161
5.00	„	phosphate of lime and the alkaline salts at £30 per ton, ...	150
7.97	„	alkaline salts at £1 per ton, . .	8
17.00	„	ammonia, at £60 per ton, . .	1020
		Value of 100 tons, ...	£1365

or at the rate of £13, 13s. per ton, so that, as compared with other substances, Peruvian guano is a cheap manure.

It must be distinctly understood that the system of valuation now described gives only an approximation to the price, and in estimating it exactly many other matters require to be taken into consideration, more especially in the case of manufactured manures. Among these the condition of the manure is of the highest importance. A damp, ill-reduced manure ought not to be valued at the same rate as a carefully manufactured sample, which has been brought into a high state of division, and the valuator must exercise his judgment in this matter, and diminish or add to the value to such an extent as he may consider right under the circumstances. In the same way the proper adjustment of the relative quantities of the different constituents must be taken into account. Thus, for example, if there be two samples of superphosphate having the following composition:—

	I.	II.
Water, ...	12.72	11.83
Organic matter, . . .	5.66	3.82
Biphosphate of lime, . .	10.77	21.30
Equivalent to soluble phosphates, .	(16.82)	(33.44)
Insoluble phosphates, . .	19.21	2.59
Sulphate of lime, . . .	48.99	54.13
Alkaline salts, . .	0.11	2.23
Sand, ...	2.54	4.10
	100.00	100.00
Ammonia, ...	0.32	0.37

and their values be calculated according to the plan just laid down, No. 1 is found worth £8 per ton, and No. 2 £11, but practically the value of the last is by no means so high, because it is found that the conversion of the whole of the phosphates into a soluble form is not attended with commensurate advantage in a manurial point of view, but that the best results are obtained when a reasonable proportion is left insoluble. In point of fact, a manure like No. 2 is sold at from £7, 10s. to £8, 10s., which may be considered as its proper value. These and similar matters must be borne in mind when selecting a manure, and form an essential element in the estimation of the value; but it must be understood that the percentage valuation must always form the basis of any system used, and is only modified by these secondary considerations.

In the purchase of manures there are many other considerations to be taken into account, such as the particular element or elements which are most especially required by the soil, and the farmer having a given sum to expend on manures, may find it at one time most profitable to lay it out in the purchase of ammonia, and at another, on phosphates. These are matters, however, which are foreign to the subject of this paper. It may be well, however, to point out that ammonia is most cheaply purchased in the form of Peruvian guano, and most dearly as sulphate of ammonia—that insoluble phosphates are obtained at the lowest rates in coprolites, next in bone-ash, and lastly, they are most expensive in phosphatic guanos; but that the high state of division of the last confers upon them their higher value. Biphosphate of lime is most cheaply purchased in superphosphates, made from bone-ash alone.

In general, however, it will be found that manures in which those substances are met with singly do not produce so good an effect as those in which they are mixed; and this fact, as well as the advantage of properly apportioning to one another the different constituents of a manure is obviously attracting the attention of manufacturers, and the number of superphosphates made from phosphates alone has recently undergone a considerable diminution, while those of which ammonia forms a large constituent are on the increase.

Of course, it is always a question whether the farmer should purchase the mixture as made by the manufacturer, or take the substances separately and mix them for himself; but this must be decided by each individual for himself, and chiefly by local considerations; although it may be observed that, in general, a mixture of Peruvian guano and superphosphate made from bone-ash, will be found among the most economical manures.

In purchasing any manure, the first step to be taken is to obtain a guaranteed analysis from the seller, which analysis should always give the date at which it was made and the signature of the

analyst. If there is no date, it may have been made years before, and apply to a manure which, though believed by the manufacturer to be exactly the same, may differ from it in every respect. If the analysis is not intelligible, or not arranged according to the rules already given, it ought at once to be rejected. If it is properly stated, the intending purchaser then proceeds to estimate the value; and if this proves satisfactory, he should at once order the quantity required. As soon as it comes into his hands, a sample should be selected, by taking small quantities from not less than six or eight bags, and this should be analysed. As the object is to check the correspondence of the stock with the guarantee, it is by no means necessary that the analysis should be complete; but it may be restricted to the more important constituents—as, for example, to the soluble and insoluble phosphates of a superphosphate, or the phosphates and ammonia of a guano. If these are found to correspond with the guarantee, the others may be assumed to be correct.

I should not fulfil my duty to the farmer without warning him as to the necessity for seeing that the analysis with which he is supplied is accurate. I am sorry to say the result of my experience is that bad analyses are as common as bad manures. I have already pointed out one source of error in the analysis of a superphosphate, but there are many others which cannot well be made intelligible except to a chemist. Most extraordinary illustrations of erroneous analyses are constantly coming under my notice, which are attributable to the rough and ready processes too often used for commercial purposes, and which are really worse than useless. The analysis of a manure is a delicate process, requiring an amount of time, attention, and experience, which I am sorry to say is not often given to it.

If the farmer attends to all these points, and is careful as to the character of the individual from whom he buys, the chances are that he will secure a genuine article. In general it is best to purchase from a local dealer, who has a character to lose in his own district; and the best method is for a number of farmers to agree together to take from him a certain quantity of some particular manure, from which a sample should be taken when it comes into stock, and analysed. In this way a single analysis will suffice for a large quantity of the manure, provided it has been delivered from the ship or manufactory at one time; but if supplied in separate lots, a distinct analysis of each ought to be made.

The farmer may rest assured that the honest dealer will second him in all his efforts to secure the quality of his manure, and will court inquiry in all respects, because he knows the result must be to his advantage. The dealer who undervalues analysis, and considers it unnecessary, sells a manure which will not bear investigation.

The purchaser of manures requires to have all his wits about him in order to secure a really good and genuine article, and to avoid loss. The facts already stated regarding the large consumption of artificial manures, will show how much scope there must be for the sale of inferior and adulterated substances; and if we suppose the extent of adulteration not to exceed ten per cent—which is probably a low estimate—the loss to the farmer must amount to L.400,000, independently of that incurred from failure of the crops on which these manures are used, and the expenses of carriage and application; a loss which might be completely guarded against by care, and by an outlay amounting to only a small fraction per cent on the value of the manure.

ON TOP-DRESSING PASTURE.

By JAMES PORTER, Monymusk, Aberdeen.

[Premium—The Gold Medal.]

The pastures of this country are extensive, comprehending nearly all lands lying under grass. A very small portion of them is annually made into hay, and even in that case the fields are generally pastured after the hay is removed.

There can be no doubt that pastures of all sorts may be much improved by judicious applications of manure; but as the various descriptions of pastures require a somewhat different treatment, I shall class them under two separate heads:—

I. Pasture on land under cultivation.

II. Old pasture, known by the name of permanent grass land.

1. When land under cultivation is in a high state of fertility, and is carefully sown with a full and well-selected mixture of grass seeds, it will often produce good grass for several years without any additional manure. This is so far fortunate for the cultivator of the land, for if the wide extent of arable land in pastures had to be regularly top-dressed in rotation, the system would be very laborious and costly. I do not wish it to be understood, however, that manure will not pay on this description of land; on the contrary, when soil and climate and other circumstances are favourable, I have found a good dressing of light manures to the first and second year's grass, prove very remunerative. After varied and numerous trials, for many years, of a great variety of artificial manures, I have come to the conclusion that guano, sulphate of ammonia, nitrate of soda, and soot, are the best light-dressings for new grass that can be applied. The large proportion of nitrogen which these contain in a state easily assimilated by plants, by its great power in developing the blade, makes such manures peculiarly suitable for the growth of young grass. To render these manures fully efficient, however, it is very desirable that they be sown in rainy weather. It is needless to add, that if the manures be not quite genuine, a partial failure must be the result. The middle of March, if the weather is suitable, is perhaps the best time for sowing them; and in regard to quantity, I have found about the value of 30s. of any one of the above-named manures to be a fair dressing for an acre of land. On light land with a gravelly subsoil, I consider it a mistake to use these manures as a top-dressing to grass, for when applied to such I have seldom seen them do much good; and in an unusually dry season, I think they can by no means be beneficial. For such soils I would prefer well-made compost of bones, urine,

vegetable mould, and salt. When near the sea, I have used a compost of sea-weed and fish refuse, &c., in the following proportions:—Say 12 loads of mould, 4 loads of sea-weed, 1 load of fish refuse, and 2 tons of cattle urine. This makes an excellent and substantial dressing for one acre of light land. When it is laid on during the winter months, its good effects on the grass in spring are all but certain; and within a short distance of the sea-coast it may be supplied for about 28s. an acre.*

So much for the manuring. I shall now state a few facts which I believe to be important regarding the management of these pastures. Heavy rolling in autumn and spring, when the land is moderately damp, does much good, for, besides making a smooth surface, it packs the soil about the plants, and tends to make them spread laterally, and form a closer sward. Frequently changing or shifting the stock on the grass, and having it well eaten down at proper periods, but not too bare, are the best means of keeping the pasture in a good and growing state. It is always bad management to allow the grass to run to seed, seeing that it weakens the vigour of the roots, and tends much to exhaust the soil. It is, in particular, absolutely necessary that all weeds be cut early in the season. Whenever, indeed, they show their tops above the ground, they should be cut a little under the surface of the grass with a sharp tool, by which process the sap vessels of the plant are left open, so as to bleed profusely, and also admit the rains, which all tend considerably to destroy the roots. It is, at the same time, desirable to keep the surface smooth by spreading the mole-heaps and droppings of the cattle, for by attention to these simple operations, the luxuriance of grass lands is always much increased.

II. Old pasture, known by the name of permanent grass land.

Under the present system of alternate husbandry now adopted in Scotland, these pastures have been very much curtailed; but although their extent is now but limited, their improvement is far more difficult than that of those in cultivation. In fact, on light soils where the pasture is very old, and where mosses have been once fairly established, it is exceedingly difficult to improve the grass properly, without ploughing them. I have repeatedly tried a variety of manures under different circumstances, with the view of

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* In some cases the 1st of March may be too early for the more soluble manures, such as nitrate of soda. Experience has pretty generally pointed out that these manures are much more effective when sown over the grasses when the season of growth is fully established. This is more particularly the case with the grasses proper. When clovers are abundant, guano can be sown with great advantage in autumn, as it then often assists in strengthening the plant, and prevents its dying out. So it is the better practice to sow guano or soot early in spring, as it has a better chance of being washed down to the roots. Though the light manures are much less certain on sandy or gravelly soils, yet on young grass, in moist summers, their effects are often remarkable, and, on the average of years, in moderate doses prove economical.—Ed.

renovating pastures. This year, 1859, I have experimented with substances recommended by the Highland Society, as well as with a few other additional kinds. The trial was made on a level field of good alluvial soil, on what may be termed haugh land. It has been in grass for at least forty years, during which time it has been chiefly pastured by sheep. It has got no manure except a dressing of powdered lime some twenty-five years ago. A good deal of moss having become intermixed with the grass, it has for several years afforded inferior pasture. It is situated in an inland part of the country, quite beyond the reach of the sea breeze, and is about 300 feet above the level of the sea. In this case, the soil being naturally dry, had never been drained; but I wish it to be understood that in all cases where the soil is wet, it should be thoroughly drained previous to its being top-dressed. The experiments were all made in duplicate, and on an extent of one-fourth part of an acre each; but as there was very little difference in the produce of the two plots with the same manures, I added them together, and give them in the following table as an experiment on one-half acre of land. The dung, earthy composts, and the lime, were spread on the 28th February, and the other manures were sown by the hand, mixed with sand, on the 16th March. The weather at the time, and for several weeks afterwards, was stormy with rain and sleet daily, so that the light manures at least must have been well washed into the soil. The dung and the compost were well rotted, and much care was taken in spreading them evenly over the land. The plots were harrowed with a pair of heavy break harrows, with the view of tearing up the moss as much as possible; and the manures were brushed in with a bush harrow, and afterwards gone over with a heavy stone roller. About the end of April very dry weather set in, and continued without intermission to the middle of June. At this time the grass on the experimental plots had made little progress indeed, being little more than distinguishable from the unmanured land. The weather now became soft and showery, and some of the dressed plots began to manifest a decided superiority over the rest, and continued to do so for six weeks. The hay was cut on the 1st of August, and tossed out and dried as quickly as possible, so that it was fit for being put in the tramp-rick on the 10th of the month, when it was weighed by steelyard, and the results are shown in the following Table:—

TABLE showing the results of EXPERIMENTS on the Hay Crop on old Pasture Land.

No of Plots.	Names of Manures used in the Experiment.	Manures to ½ Acre	Cost of Manures per cwt	Cost of Manures per ½ Acre	Weight of Hay per ½ Acre	Weight of Hay per Acre	Value of Hay per Acre at 3s per cwt	Increased weight of Hay per Acre compared with No 6	Increased value of Hay per Acre compared with No 6
		cwts. qrs. lbs.	£ s d	£ s d	cwts. qrs. lb	tons cwts qrs. lb	£ s d	cwts. qrs. lb	£ s. d.
1.	* Lime, 5½ bolls at 3s 10d. per boll, .	0 0 0	0 0 0	1 1 0	9 0 0	0 18 0 0	2 14 0	0 0 0	0 0 0
2.	Farmyard dung, 6 yards at 3s. 6d per yard, ...	0 0 0	0 0 0	1 1 0	12 2 0	1 5 0 0	3 15 0	6 0 0	0 18 0
3.	Earthy compost, 12 yards at 1s. 9d. per yard, ...	0 0 0	0 0 0	1 1 0	12 1 21	1 4 3 14	3 14 7½	5 3 14	0 17 7½
4.	Peruvian Guano, ...	1 2 13	0 13 0	1 1 0	17 0 0	1 14 0 0	5 2 0	15 0 0	2 5 0
5.	Nitrate of Soda, ...	1 0 15	0 18 6	1 1 0	16 0 14	1 12 1 0	4 16 9	13 1 0	1 19 9
6.	No manure, ...	0 0 0	0 0 0	0 0 0	9 2 0	0 19 0 0	2 17 0	0 0 0	0 0 0
7.	Sulphate of Ammonia, ...	1 0 19	0 18 0	1 1 0	17 1 14	1 14 3 0	5 4 3	15 3 0	2 7 3
8.	Superphosphate of Lime, ...	3 0 0	0 7 0	1 1 0	13 3 14	1 7 3 0	4 3 3	8 3 0	1 6 3
9.	Sulphate of Potash, ...	2 0 23	0 9 6	1 1 0	15 0 0	1 10 0 0	4 10 0	11 0 0	1 13 0
10.	Muriate of Potash, ...	1 0 15	0 18 6	1 1 0	11 0 0	1 2 0 0	3 6 0	3 0 0	0 9 0

* N B —The boll of lime is about 3¾ cwt The compost contained 12 yards clayey mould and 3 tons cattle urine

The best proof that I can give of the artificial manures being genuine, is the subjoined analysis, which was made specially for this experiment by Mr James S. Brazier, Lecturer on Chemistry in Marischal College, Aberdeen.

1st.—*Analysis of Lime.*

It consists of, in 100 parts—

Caustic lime,	89.60
Silica,	1.50
Iron and alumina,	1.90
Magnesia,	2.57
Moisture and loss by ignition, with a trace of carbonic acid,	3 20
Difference,	1 23
	100.00

There was a small trace of sulphuric acid, which existed rather as gypsum, or in company with alkalies.

2d.—*Farmyard Dung.*

It consists of, in 100 parts—

Moisture,	81 89
Organic matter,	12.44
Mineral matter,	5.67
	100.00

When dry it consists of, in 100 parts—

Organic matter,	68.69
Mineral matter, 31.31, as under; portions soluble in water, consisting of alkaline salts,	5.53
Portions soluble in acids, consisting of carbonate of lime and magnesia,	4.14
Phosphate of iron, lime, and magnesia,	5 97
Residue—silica, &c.,	15.67
	100.00

There is 0.410 per cent of nitrogen, equivalent to 0.493 per cent of ammonia, in the moist manure, and 2.27 per cent of nitrogen, equivalent to 2.756 per cent of ammonia in the dry manure.

4th.—*Peruvian Guano.*

It contained, per cent—

Moisture,	15.60
Organic matter,	51.54
Phosphates,	25.60
Alkaline salts,	7.26
	100.00

The guano contained 14.29 per cent of nitrogen, equivalent to 17.35 of ammonia.

The phosphoric acid in alkaline salts amounts to 2.25 per cent, equivalent to 3.12 of biphosphate, soluble phosphate of lime.

5th.—Nitrate of Soda.

It contains, per cent—

Moisture,	1.10
Organic matter,	1.00
Insoluble matter,	0.23
Chlorides,	1.00
Nitrate of soda,	96.67
	100.00

The nitrogen is therefore 15.92 per cent. This amount of nitrogen would be equivalent to 19.33 per cent of ammonia.

6th.—Sulphate of Ammonia.

It contains, per cent—

Moisture,	1.50
Impurity,	0.50
Sulphate of ammonia,	98.00
	100.00

Containing, therefore, 25.24 per cent of ammonia.

7th.—Superphosphate of Lime.

It contains, per cent—

Organic matter,	21.70
Biphosphate, equivalent to 20.00 of bone-phosphate made soluble,	12.82
Insoluble phosphates,	18.60
Gypsum, moisture, and residue,	46.88
	100.00

The superphosphate of lime contained nitrogen equivalent to 1.87 of ammonia.

8th.—Sulphate of Potash.

It contains, per cent—

Moisture,	13.30
Impurities, principally chloride of sodium,	27.40
Sulphate of potash,	59.30
	100.00

9th.—Muriate of Potash.

It contains, per cent—

Moisture,	10.20
Impurities—such as sulphate and chloride of sodium,	6.72
Muriate of potash,	83.08
	100.00

All the manures were laid on at a cost of £2, 2s. per acre for each kind, which may be considered a high price for top-dressing one acre of pasture land; but as the grass was old, and a good deal of moss in it, it could scarcely be expected that very slight dressings would produce any considerable effect. The extreme dry season was most unfavourable for the experiment, and, as the

Table shows, the returns are far from being good; so that this experiment adds one to the many disappointments experienced by farmers, arising from the uncertain results of surface-manuring.

On some of the plots the extra produce of hay will do little more than pay the cost, while in others the price of the manures is nearly altogether lost. It must also be borne in mind that the soil is good, and well sheltered from the drought, otherwise the results might have been still worse than they are. The saline manures, it is to be expected, will do little, if any, good next year. The second crop of grass looks a little more fresh after them, but they have done little indeed in extirpating the moss. The dung and the compost will no doubt be more permanent; the latter, in particular, appears to have already done a good deal in destroying the moss. The lime was against, rather than in favour of the hay crop; but at present (20th October) its good effects on the pasture are becoming quite apparent—the moss is considerably decayed, and the surface already feels much firmer to the foot; the white clover is beginning to sprout up thickly, and the whole surface appears greener and feels firmer than that of any of the other plots. The effects, it is to be expected, will gradually become more visible as the lime sinks into the soil, and I have little doubt that, in the course of a year or two, its beneficial effects will be far more apparent. For this description of pasture land, particularly where the soil is rich in vegetable matter, and inclined to clay, powdered lime has the most powerful effect in renovating the grass of any substance I have ever tried. It at once cleans the surface, kills insects, decomposes decaying vegetable matter, and raises a close sward of sweet nutritive grasses, including considerable quantities of white clover, and cattle will prefer the grass growing on the limed land. Light dressings, and repeated when necessary, is perhaps the best way to apply lime. I found two tons an acre to be perfectly sufficient; and the autumn or winter months will no doubt be the best time for applying it to the land. Where the land is very much infested with moss, it will not, perhaps, extirpate it entirely, but it destroys it more than any other manure I have tried, and thereby prevents its choking the grasses—at least for a good many years after. It is quite clear that mossy pastures should be well torn on the surface before spreading on manures of any description, which would allow them to be better covered from the action of the weather, and give them a much better chance of destroying the moss. For this purpose, I have never seen a proper implement that could accomplish the work in a satisfactory way; the common break-harrows are generally had recourse to, and they are only a mere apology for an implement for performing such a tough and formidable operation; they jump and pinch the shoulders of the horses, and take on too broad a space at a time for doing proper execution. Scarifiers of different forms I have seen tried, but they

also do not work satisfactorily, and perhaps any implement made to draw directly forward, on the harrow principle, will never be likely to answer the purpose. It occurs to me that a machine made on the revolving principle would be easier drawn than any other kind, and much more effective. Say a good strong cylinder, about three feet long, set with strong iron spikes, not too close, mounted upon wheels, and adjusted in such a way as the spikes could be let out or into the ground at pleasure. If the machine performed the work in a satisfactory way, three feet long, I presume, would be about draught enough for a pair of horses; and by being short, it would be the better adapted for the hollows, in which old grass-lands generally abound. In this age of improved implements and machines, perhaps the Highland Society might think it proper to offer a premium for a machine of this description; and should they happen to succeed in bringing out a useful one, I am sure they would confer a boon on the owners of old grass-lands; and it might not be a very inappropriate appellation to give it the rustic name of the "fog plucker."

Light gravelly soils, deficient in vegetable matter, are at least unsuitable for the permanent growth of grass; but there are, no doubt, some isolated cases where it is desirable to keep them in that way, and it is then a very expensive matter to keep them in a healthy growing state.* Quick-lime must be but sparingly dealt with, and other manures involving more labour and cost must be had recourse to. For such soils, I have frequently found the following compost to have a very good effect:—Say 20 loads of mould (the more clayey the better), 15 cwt. quick-lime, 6 bushels bone-dust, and 4 cwt. salt to 1 acre of land. Some years ago I dressed a good many acres with this mixture, and sowed it with hard fescue and meadow fescue grasses, 1 peck each, with 2 lb. white and 1 lb. of yellow clover to the acre. Grass seeds may be sown with advantage where earthy compost has been applied; but otherwise it is of no use to sow grass seeds of any sort on the surface of old mossy grass-land. Of course, the seeds must be well harrowed among the compost, and the whole afterwards properly rolled. The grass on the field above alluded to was much improved for six or seven years, after which it gradually began to fill up with coarse grasses, and to revert to its former unprofitable state. Wood and peat

* Light gravelly soils are certainly less suitable than loams for permanent pastures, but they are abundantly susceptible of improvement from top-dressings. Quick-lime applied as a top-dressing is seldom attended with other than favourable results, so long as such land is kept in pasture. Bad results only follow when the land is put under the plough and severely cropped. Indeed, a moderate dressing of lime applied to light land when worn out, imparts to it the conditions of maintaining cocksfoot and some other valuable grasses, and it often improves for many years. As contended for in the report, the destruction of moss may be greatly hastened by mechanical means; but it must be borne in mind that its existence depends on certain conditions of soil which are unfavourable to the growth of the grasses.—ED.

ashes, where they can be got, make excellent dressings for this sort of land. In proof of this, it may be noticed that where fires of wood or peat ashes have been burned, even on the sides and tops of our barren hills, the growth of grass is there promoted, and for years after. The white clover also often springs up spontaneously where no plants but the stunted heath and the wiry bent grass had ever before been known to grow. The plan of folding sheep on old grass-land, and feeding them with turnips in winter, I have sometimes adopted. This, no doubt, improves the surface and destroys the moss partially, but it does not root it out. The sheep, too, invariably refuse to pasture on the same ground afterwards, if they have a choice of other grass.* In some soils, where the grass is much overrun with moss, I believe it is impossible to get it fairly eradicated; for if once it is closely rooted in the soil, even the best scarifiers and the most potent manures will all fail to extirpate it. Ploughing it up, and putting it through a course of cropping, is the only way of properly renewing it. Such land is unsuitable for permanent grass; and whenever it begins to deteriorate and fill with moss, it is high time to plough it up and sow it anew. It is really of no use to spend labour and money on such lands, endeavouring to keep them in grass, when more profitable results would be sure to follow by breaking them up. Permanent grass should be confined, as far as possible, to strong clayey loams and rich alluvial soils. It is quite against the nature of things to encourage the growth of it on the light description of gravelly soils. Wherever, indeed, it is attempted to do so, it must always be at a great disadvantage.

Concluding Remarks.—From what has been said it will be seen that my experience in top-dressing pastures may be summed up thus:—

I. On strong soils on lands under cultivation, guano, sulphate of ammonia, nitrate of soda, and soot, are the best, and that they will prove remunerative if the weather is not too dry. The first three, even in the unfavourable season of 1859, held a high place in the experiment detailed.

II. On light soils in alternate husbandry, composts of earth, bone-dust, cattle urine, salt, seaweed, and fish refuse, are the most suitable.

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* The folding of sheep in winter on grass, with the view of improving it, is a practice which should be followed with caution. Errors are often committed on this head. On the stiffer soils, a great deal of injury is done to pasture lands by carting turnips upon them to be consumed by sheep In soft weather, the feet of the animals sink into the ground, and tend to weaken the finer grasses, making them thin-out instead of thicken. As the spring advances the surface becomes hard and most ungenial to the roots. The manure is no compensation for this trampling of the surface. A soft surface, it should always be borne in mind, is one of the prime requisites to the luxuriant growth of grasses. Unless, therefore, in particular instances, light manures, which have no mechanical action on the soil, are not so relatively valuable for old pastures as for other crops on land under cultivation.—Ed.

III. For old grass on strong soils, powdered lime is the most effectual dressing that can be applied. Although it did not stand well in this experiment, its good effects may be fully expected.

IV. For old grass on light gravelly soils, clayey compost, mixed with quick-lime, bone-dust, and salt, makes a good dressing, and peat and wood ashes produce an excellent effect. Should all these fail to make good pasturage, then certainly it ought to be ploughed up.

We are told by Professor Johnston that the bones of the sheep contain 70 per cent phosphate of lime; and that a milch cow carries off annually 30 lb. of bone-dust from the land; and if this waste is to be supplied, as it certainly ought, there can be no better way of doing it than by adding bones, lime, and other phosphatic manures to the land. Let our grazing lands, then, be liberally dressed, where necessary, with these manures, and we shall have abundance of grass. When the supply of bones fails, we may have recourse to coprolites; and when the pastures in our low valleys have all been clothed in their deep green verdure, we may with propriety extend the system to the pastoral glens, and the lime and the bone earth will soon make a favourable change on the hillsides of the country.

On the NATURAL HISTORY of the TURNIP-FLY (*Haltica Nemorum*), and on EXPERIMENTS undertaken with the view of ARRESTING its RAVAGES.

By the Rev. James Duncan, Denholm, Hawick.

[Premium—The Gold Medal.]

The depredations of this little insect are becoming every year more and more formidable. Its increase keeps pace with the extension of the turnip crop, and threatens to interfere very seriously with its profitable cultivation. In very dry seasons, such as 1858-59, even during the time of the sowing and brairding of the turnip, it has abounded, at least in many parts of the country, to such a degree as speedily to destroy the whole of the young plants, and it was only by repeated sowings that a crop could ultimately be secured. In such cases, it is not only the loss of the seed and additional amount of labour that are to be lamented, but the crop is made late, and therefore more liable to be overtaken by frost before it has completed its growth. These circumstances render some means of destroying these insects, or guarding against their attacks, in the highest degree desirable; for if allowed to go on unchecked, they may, in combination with its numerous other enemies of the same class, cause the rearing of the turnip to be

attended with great difficulty, or attainable only by an outlay too considerable even for that crop, important as it is, or even indispensable to the economy of a farm of mixed husbandry under the present system of management.

There are certain points in the natural history of the turnip-beetle which I have long considered deserving of further investigation; and having entered upon the inquiry early last spring, I was led to follow out the subject in order to discover, if possible, some remedy against its attacks. With this view, a variety of experiments were undertaken, some of them on a large scale, both for the purpose of testing the value of the remedies which have been recommended as effectual, and trying the effect of new applications. As the Highland and Agricultural Society of Scotland have solicited communications on this subject, I beg to submit to their notice some account of the nature and results of my experiments and observations.

In all cases of this kind the first thing to be determined is the natural history of the insect, its habits, metamorphoses, food, times of appearance, &c. Unless remedial measures are founded on a knowledge of these, they must be more or less of an empirical character, and not likely to prove effectual. In the present instance I have carefully traced the insect through all its changes, and find that its history, upon the whole, pretty nearly corresponds to that first given by Mr H. Le Keux in the *Transactions of the London Entomological Society*, and which has been repeated, with little variation, by Mr Curtis in a paper on this insect in the second volume of the *Journal of the Royal Agricultural Society of England*.

It belongs to a considerable tribe of small Coleopterous insects or beetles, which are readily distinguishable from all others of the same order, with one exception, by having the thighs of the hinder legs much thickened, somewhat after the manner of grasshoppers, and thereby fitted for leaping; hence the genus has been named *Altica*, from αλτικος, a leaper—or with the aspirate, *Haltica*. This power is of great use to it when moving among grass and thick herbage, and, by facilitating its motions, adds greatly to its means of doing mischief. I have seen it leap upwards of two feet at a spring, which, in a creature of such small dimensions, implies a great exercise of muscular power. The exception alluded to above is a tribe of small weevils, which have the same saltatory power conferred on them by a similar structure; but these, again, are easily known by having the front of the head prolonged into a narrow beak or rostrum. An example of this kind may be readily seen in the small weevil (*Orchestes Fagi*), which drills so many small holes in the tender leaves of the beech just when they are expanding.

The turnip-beetle varies in length from a line to nearly a line and a half, the larger-sized individuals being commonly females,

the smaller males. The colour is brassy black, the surface smooth and shining. The antennæ, which consist of eleven joints, are black—the second and third joints, and the whole or a portion of the first, pale yellowish. The head is rather small and black; the thorax considerably broader, convex above black and punctured; the wing-cases, which are much wider than the thorax, also black, thickly and irregularly punctured, each of them with a pale-yellow or sulphur-coloured stripe running along the centre, curved inwards at the hinder extremity, and not reaching quite to the apex; the form of this stripe varies a good deal, being sometimes curved or sinuated on its outer margin The under-sides of the body and thighs are black, the other parts of the leg pale or yellowish; thighs, or upper portion of the hinder legs, much thickened, the terminal division, or that next the foot, consisting of four joints, the third bi-lobed, and the fourth tipped with two claws. It is unnecessary to describe at length the various organs of the mouth; but the mandibles, or upper jaws consist of two strong pieces, one on each side, with three or four strong angular teeth, fitting into each other like the fangs of a rat-trap. The action of these two cutting instruments is horizontal; and as they are strong and trenchant, the insect has no difficulty in breaking up the cuticle of the leaf, and separating portions of its substance, which undergo a further process of mastication by the maxillæ, or under-jaws, before they are swallowed.

Fig 1.

Fig 2

The Latin scientific name of this insect, *H. Nemorum*, is almost as inappropriate as its common English one, Turnip-fly, by which it is liable to be confounded with other insects to which the name of fly properly belongs. Now that its history is understood, it

should certainly be changed into one more significant, either *Haltica Rapæ*, or, what would be better still, *H. cruciferarum*. The turnip is not its only, perhaps not even its favourite food, as there will be occasion afterwards to show. Meanwhile we shall proceed with the description of it in the other stages of its metamorphoses before it assumes the perfect form, or that of a beetle, which has just been noticed.

For the purpose of breeding, the female beetle selects the rough leaves of the turnip, and also, as I have this season ascertained, those of the wild mustard (*Sinapis arvensis*) and wild radish (*Raphanus Raphanistrum*), known throughout the south of Scotland as *the runch*, one of the most troublesome weeds the farmer has to contend with. She lays her eggs on the under-side of the leaf, a situation in which they are best protected from the weather. They are smooth and oval, of a light-greenish colour, and appear to be deposited singly in one spot, or in very small clusters. They are so minute as not to be discernible unless by a considerable magnifying power. They are hatched in eight or ten days, and the young grub or larva eats its way into the central pulp of the leaf. Here it mines for itself a gallery or winding path between the upper and lower cuticle of the leaf, consuming the pulpy matter that lies between; and even when full grown, its dimensions are still so small that it finds ample scope and verge enough within this narrow dwelling. It thus affords a rare, if not a solitary instance, among Coleopterous insects, of a mode of life so frequently exemplified by the caterpillars of the smaller moths, whose serpentine paths we witness so often on the leaves of roses, lilacs, and many other plants, presenting a pale undulating or zigzag line on the green surface, like the windings of a river on a map. These pathways are not often of great length, the insect advancing very slowly, and they frequently commence near the edge of the leaf, and tend inwards in the direction of the midrib. (See p. 466, figs. 1 and 2, *a, a, a*). Sometimes the grub consumes the pulp on all sides of it without advancing in a linear direction, and in such cases an area is excavated in which I have occasionally seen two or three grubs at work (figs. 1 and 2, *b, b*). The presence of these larvæ may in general be easily detected, for they leave a pale mark on the upper side of the leaf, and on looking at them from beneath, especially when the leaf is held up to the light, we can observe them, even with a common magnifying-glass, through the thin pellicle that covers them, surrounded with small black dots (the excrements), which, however, more frequently form a dotted line behind, which marks the insect's path. When the larva leaves its burrows, the excavated portions wither, become shrivelled and discoloured, giving the leaf a blotched and unhealthy appearance; the blemishes, however, are too small and insignificant to interfere with the growth of the leaf. In a plot

of early turnips I found these larvæ in great abundance by the middle of May, and on examining, about the same date, a field covered with runches or wild radish, I found several on almost every leaf. Although the perfect insect is so partial to the seed-leaves, I have never found the larvæ intrusted to them, probably from an instinctive prescience that they are too shortlived to form a safe receptacle for the young brood.

These larvæ scarcely exceed a line, or a line and a half, in length. They are at first pale and almost gelatinous, but the head soon becomes dark, the first and last segments with a dark dorsal patch, and each segment having a few transverse dusky dots. The three segments behind the head have each a pair of conical feet, like those of true and false caterpillars, and the terminal one is furnished with a proleg. They are pale and fleshy, like most of those which live in the interior of vegetable substances. When full grown, which is in about sixteen days, they make an opening in the cuticle, and drop into the soil, where they bury themselves an inch or two below the surface. There they soon assume the inactive state of pupa, and from this, in a short period, the beetle emerges, and finds its way into open day.

It thus appears that upwards of a month is occupied by this insect in going through its various transmutations, the longest period, as is usual with the phytophagous or plant-eating species, being spent in the larva state. The perfect insect lives for an entire season, if not for a longer period, and there is, no doubt, a succession of broods throughout the summer.

It is in the latter state alone—namely, as a beetle—that it inflicts serious injury on the turnip crop. No sooner are the two seed or cotyledon leaves unfolded, than they are liable to be attacked. The insects eat numerous small holes into the pulpy matter, thereby destroying the cellular tissue, and either so riddling the leaves that they can no longer maintain their growth, or entirely eating them off the stalk. I have seen from five to seven at work on the same seed-leaf; and as it is of small dimensions, it may easily be judged how little chance it has, in such a case, of escaping destruction. The insects continue to frequent and feed upon the rough leaves, which they likewise perforate with numerous small holes (page 466, figs. 1, 2, c), until they are frequently riddled like a sieve. It must not, however, be supposed that this is wholly the work of the Haltica, for it will be always found, on examining a turnip-field, that numerous small weevils (chiefly of the genera *Nedyus* and *Ceutorhynchus*) frequent the plants, which likewise bore into the leaf with their auger-like proboscis. It is its habit, after making one round hole, to proceed to another spot and make a similar perforation; sometimes, however, it continues in one place till it has cut out a pretty large angular opening. These perforations are always in the spaces between the nervures, for we never

notice that the latter, especially the larger ones, are eroded. However numerous they may be, they do not appear, as already intimated, to affect the growth and general health of the leaf, which continues to expand, although it has all the appearance of having received a discharge of small shot.

The operations of insects generally are much influenced by the state of the weather, and this is seldom more strikingly exemplified than in the present instance. The time of the turnip beetle's greatest activity is during calm and dry weather, and while the sun is shining. It then jumps about with great agility, and is seen frequently to take wing, for its wings are of ample dimensions, enabling it to fly with facility. It thus unfortunately happens that the very weather which retards the growth of the plant excites the insect's voracity, and this untoward coincidence often proves fatal to the crop. In cloudy and damp weather, it is dull and inactive, never seen on the wing, but resting on stones, among clods of earth, or on the under side of leaves. Wind is also unfavourable to it, and keeps it in a quiescent state; but continued wet and cold seem almost to paralyse it, and in seasons having that character we need scarcely apprehend much injury from it. So necessary, indeed, does sunshine seem to its welfare, that the sides of fields with high hedge-rows and places partially shaded by adjoining trees, have been observed to be more or less exempt from its visits.

Before being so well acquainted with the economy of this insect, as further observation has enabled me to become, one of the circumstances that puzzled me most was to account for its sudden presence in such numbers as soon as the turnip plants pierced the soil. The two events are simultaneous, the appearance of the plants and the insects; and that not in scattered individuals, such as may be supposed to have survived the ordeal of winter, but too often in full force, in numbers without number. As long as the insect was supposed to breed on the turnip alone, this fact appeared inexplicable; and no wonder that many strange notions were formed as to its mode of propagation. Some supposed that the eggs were laid in the ground, and hatched by the heat of the sun; others that they were deposited in the manure; while not a few believed that they were attached to the turnip-seed, and as the latter germinated the larvæ were hatched, and ready to commence their attacks. There can now be no doubt that the insects assemble from the adjacent fields, hedge-rows, road-sides, &c., sometimes coming from a considerable distance, and that they consist of the individuals which have survived the winter, by a kind of hybernation, *reinforced by a young brood, the produce of the current season.* The nurseries where this brood has been reared are chiefly the patches of wild radish and mustard which we see so frequently in waste places and ill-culti-

vated lands. Turnips kept over the winter for rearing seed will also contribute their quota, and probably many other cruciferous plants, for the insects that feed on this tribe of plants generally range over a considerable number of them, the family being an exceedingly natural one, and the properties of the plants being therefore very similar. It is asserted that the horse-radish, the different kinds of brassica, ladies' smocks (*cardamine*), hedge-mustard, and various other common plants, are resorted to for food; this, however, I cannot affirm from my own observation. The two first alluded to are sufficient to account for the results we observe. Both of them throw out their leaves early in spring; the runch, indeed, I have seen growing even in mild winters; and so rapid is its progress when the spring commences that it derives its generic name from the circumstance.* It is in full flower in May, and continues in bloom all the summer. Nearly the same things may be said of the wild mustard. Both these plants spring up in corn fields shortly after the grain is sown, soon overtop the young blade, and cover the field with their gay but unprofitable bloom; and if they are to be regarded as an indication of indifferent farming, the indication is not rare in Scotland. What we have now to state will, we hope, be regarded as an additional reason for their more effectual extirpation. These plants form a ready and sufficient pabulum for the beetle when it is first roused from its winter lethargy by the returning warmth of spring, and, soon pairing, the female finds in them a proper nidus for her eggs, and the support of the young larvæ, which thus undergo their changes; and the perfect insect is ready for the young turnip plant as soon as it makes its appearance. A turnip field attracts them from all quarters; and it is certainly a wonderful instinct by which they are so unerringly guided to their suitable breeding places and stores of food. It is usually supposed to be the sense of smell that so leads them, excited by the effluvium from the plants diffused through the air. Coming, as they do, often from a considerable distance, it is scarcely possible to conceive that the odorous emanation should spread so wide; and, in our ignorance of the real nature of the senses in these creatures, it is safer to suppose that they are endowed with a peculiar faculty, to which we have nothing strictly analagous, and of which, therefore, we can form no adequate notion, by which they are infallibly conducted to the spots where they can subsist in comfort, continue their kind, and thus fulfil the purpose intended for them in the general scheme of insect life.

We are thus enabled to account for the sudden appearance of the insect, and in such formidable numbers, along with the first braird of our earliest turnip crops, and from the ample means of

* *Raphanus*, from *ῥαδίως*, easily, or early: and *φαίνω*, I appear.

breeding which the extent of these crops now everywhere afford it, we not only find it prevailing till the latest period of the season in which the plant can grow, but there is every likelihood that it will continue rapidly to increase throughout the country, unless some means can be adopted either for destroying it, or, what would equally answer the purpose in the present case, effectually driving it away from the young plants. Having given the history of the insect with some degree of detail (although in such a case it is scarcely possible to be too particular), we shall now proceed to consider what measures it may be most desirable to adopt by way of remedy and prevention.

It seems to be agreed by all writers on the subject I happen to have seen, that little of this kind can be attempted while the insect is in its two earliest stages, those of egg and larva; and, indeed, it appears reasonable to suppose that no application could be made of sufficient strength to destroy them, without at the same time damaging the plant. Their situation, too, on the under-side of the leaf, or actually imbedded in its substance, would render it difficult to make any application in such a way as to reach them. But it has occurred to me that there is one operation in the ordinary course of turnip-culture, which affords so favourable an opportunity for destroying multitudes of the insect in the larva state that it should never be neglected. About the time the thinning of the turnip-rows takes place, the rough leaves are charged with the eggs and the first brood (reared on that plant) of the larvæ. The plants thinned out are left to wither between the drills, and as they die, which they do pretty speedily in dry weather, all the eggs, and probably all the very young larvæ, die with them. So far, therefore, the operation, even as at present conducted, is beneficial in reducing the ranks of the enemy. But it should be remembered that many of the larvæ are now full grown, or nearly so, and these, requiring little or no more food, make their way into the soil, where they become pupæ in all security. In regard to all such, therefore, we only facilitate or slightly hasten the natural process. To prevent this, what I have to suggest is, that all the plants cast out in thinning should be collected, carried off the field, and destroyed. This could be done with very little trouble, and there can be no doubt that multitudes of the insect would be thus got quit of. So much am I convinced of this, that I could wish farmers were impressed with the importance of this suggestion.

On looking at the methods that have been proposed for preventing the attacks of this insect, we are at first struck with their multiplicity, their diversity, and the conflicting nature of the results. From the two first-mentioned circumstances we at once infer that no *specific* has been discovered, no single mode of treatment which can be relied on as in all cases effectual, and which would therefore supersede every other. And from the last-mentioned circumstance

—namely, the varied and frequently contradictory nature of the results—we are led to believe that the same or a similar treatment may be attended with different effects in different localities, owing possibly to the nature of the soil, the state of the weather, and other influences which it is difficult duly to estimate. All these methods, many of which are mere suggestions without any experimental proof, it is not proposed to notice on the present occasion. A selection was made of such as were thought most likely to be successful, and subjected to experiment with a view of testing their efficacy; others have been tried, it is believed, for the first time. Of these experiments I shall now proceed to give some account. Even when they altogether failed, or proved only partially successful, they will not be without use, as showing that certain substances frequently reported to be efficacious, are not to be relied on, and the expense and disappointment consequent on their use thereby avoided.

The following experiments may be divided into two classes:—1st, Those which attempt to drive off the insect by a particular treatment of the seed; and, 2dly, Those which aim at the same object by an application to the plant after it has sprung—or a top-dressing, as it is called.

If the first of these objects could be accomplished, it would be by far the simplest and least expensive method of prevention. Nor does it seem, theoretically, so unpromising as not to justify the trial. The case of pickling wheat is not, perhaps, strictly parallel, but it at least shows that a certain treatment of the seed may influence the character of the future plant. If, in the case of the turnip, some quality affecting the taste or smell could be imparted to the seed, which, extending from it to the young plants, should render them obnoxious to the insect, the object would be attained. When the seed germinates, the ascending stem carries it upwards along with it, and the shell of the ruptured seed often adheres for a length of time to the cotyledon leaves, so that time might be supposed to be thus afforded for imparting to the latter some of the properties with which the seed may have been impregnated. It is quite conceivable that in this way the juices of the plant may become tainted by absorption. But however this may be, the frequent reports I had heard of prepared seed proving an antidote to the fly, rendered some testing experiments indispensable. It is many years since I was informed, by an eminent agriculturist, that a friend of his completely preserved his crops from attack for many successive seasons, while those of his neighbours suffered, by keeping the seeds in flour of sulphur, and then sowing some of the sulphur along with them. This substance has probably been often had recourse to in this case, from its efficacy in other instances against insects—the hop-fly, for example. I was further informed that an equally effective method was to smear the seeds with oil,

and then roll them in sulphur, a quantity of the latter thus adhering to the seed with considerable tenacity. Regarding this as the most efficient mode of employing the sulphur, and considering, moreover, that the oil might promote the germination of the seed by exciting its vitality and keeping it in a moist state, I adopted this method of testing the value of this application. A very small quantity of fine oil was found sufficient for the purpose; about a wineglass-full to a pound of sulphur. In some instances, where the oil was used somewhat more plentifully, the sulphur adhered in such quantities as to make it difficult for the seed to run from the funnel of the turnip-drill; in other cases a thinner coating was applied. Two fields, the one of 17, the other of 19 acres, were sown with seed of the Swedish turnip thus prepared, a small portion of each being sown with unprepared seed for the purpose of comparison. The plants appeared in about the usual time, and seemed vigorous and healthy. The weather, however, was unusually dry, and their growth consequently slow; and scarcely had the seed-leaves unfolded themselves, when they were invaded by myriads of the Haltica. I never saw the insect in greater numbers; and owing to their vigorous attacks, and the absence of moisture, which prevented the plants making any effort to repair the damage, the whole crop in a short time completely disappeared. I could not observe any difference in the depredations of the insect in the parts of the field with prepared, and that with unprepared, seed: in both cases the destruction was equally rapid and complete. After a time the field was resown with seed in its natural state, and the weather having by that time undergone a change, a crop has been secured, but it is late, and it will depend upon the character of the later part of the season whether it prove of much value.

Although the above experiment, conducted with all possible care and attention, failed in this instance, it is proper to state that seed so treated has been supposed to preserve the turnip crop from the insect in other cases. One individual, in particular, affirms that it has for many years proved a preservative in his hands. The expense of the application is so trifling as scarcely to deserve being taken into account; neither is there much trouble attending the operation. I wish, therefore, that my experience of it had enabled me to report more successful results.

The next experiment tried on the seeds was by steeping them in brine. Salt was melted in water till the water was completely saturated, and the solution of great strength. The seed was steeped only a short time (about five minutes), in the apprehension that a longer immersion might endanger its vegetative powers. Twenty drills were sown with the seed subjected to this treatment. The plants seemed somewhat longer in brairding than in the adjoining drills, but when they did appear the insects frequented

them, and fed upon them in the same way they did on the others which had undergone no medication. I could observe no difference in the results; and although a crop was ultimately saved, it was owing to no abatement in the insect's voracity.

Anxious, if possible, to establish the fact or principle that, by subjecting the seed to a certain treatment, qualities might be imparted to the young plant springing from it capable of repelling the insect from using it as food, I considered what substances the pharmacopœia might afford most likely to accomplish this object; and without knowing at the time that it had been used for the same purpose on another occasion, my choice fell on assafœtida. I was led to this substance from its excessively pungent and nauseous smell, hoping that what was so obnoxious to the human sense would prove equally so to that of the insect. The expense of this substance is too considerable to admit of it being used otherwise than as an experiment; but I thought that if I could succeed with any one substance, an important point would be established, and probably other matters, more easily obtained, might be found to produce the same effect. The assafœtida, both in a powdered state and as a solution, was of the best quality.* In the former state it was mixed with the seed, the two being well rubbed together; and some of it was made to adhere to the seed by a smearing of fine oil, as was done with the sulphur. About an acre of a turnip field was sown with the seed thus prepared. It had no apparent effect on the germination of the plants, and they grew for a time seemingly with greater vigour than those in the adjoining drills; soon, however, they were equally assailed by the insect. From all that I observed, I could not affirm that the assafœtida, used in this way, had any influence in saving the plants from attack. The experiment, as to the success of which I was somewhat sanguine, was conducted with due care, and the result may be accepted as conclusive, as far at least as a single trial can be regarded in that light. This conclusion, moreover, is corroborated by what was observed when the same substance was applied in another way, as afterwards to be noticed.

I did not attempt to vary further these experiments on the turnip-seed. No substance occurred to me which was likely to act with greater energy than those employed, and at the same time leave the vitality of the seed unaffected. It is impossible to say how far the qualities of the substances applied were imparted to the young plants, or what changes they may have produced by becoming mingled with the vegetable juices. We are by no means warranted

* It is very difficult to reduce this substance to the state of a fine powder, which was necessary for its application in this case; this, however, was done for me by Mr Robertson, chemist, 35 George Street, Edinburgh, under the direction of my friend Henry Stephens, Esq., author of the *Book of the Farm*, who took much interest in these experiments, as he does in everything relating to agriculture.

to affirm that they were attended with no effects of this nature—the contrary is highly probable; but that they proved insufficient to drive off the insect, will appear in no degree surprising when we observe the effects of the same materials when applied to the plants in another way, as about to be noticed. If any such treatment of the seed as has just been spoken of were found effectual, it would have the great additional advantage of easy application, which is by no means the case, at least in fields of great extent, with any description of top-dressing or application to the plants after they have sprung. To the experiments of this nature undertaken by me it is now necessary to advert, and a comparatively brief notice of them will suffice.

As the substances used had to be sown along the drills by the hand, the experiments with them were of comparatively small extent—quite sufficient, however, to test their value. Besides trials in the field, the experiments in question were repeated on turnips sown in pots, and placed in the centre of a small plot of turnips which was overrun by the Haltica; these, being at all times at hand, afforded ample opportunities for observing the habits of the insect, and trying means of warding off its attacks. The results of the trials made with these very nearly corresponded to what was observed in the field.

Flour of sulphur was again employed, and strewed plentifully with the hand along the rows as soon as the plants appeared above ground. On first falling among them, it seemed to discompose the beetles considerably; they leapt off in apparent alarm, and retired to some distance. This, however, was a very temporary retreat, for on examining the plants some time afterwards, they were found to be at work as actively as ever. In fact, it did not appear to me that the presence of the sulphur rendered their food in any degree distasteful to them; at all events, I have watched the insect, through a magnifying-glass, feeding on plants in the pots above referred to when the seed-leaves were so thickly powdered with sulphur that no portion of the pulp could be swallowed without the powder accompanying it. After witnessing this, I ceased to entertain any expectation of this substance acting as a preventive, in whatsoever way applied. In the field, accordingly, no beneficial effect was observed to result from it. As with all powdery applications, moreover, especially of a light and unadhesive nature, it is liable to be washed off the plants by the first passing shower, or blown away by the wind; so that even if it were efficacious, as it is completely the reverse, several renewals would be necessary, entailing a degree of trouble which no one would like to incur.

Nearly the same statements may be repeated in reference to the assafœtida, when applied to the plants as a powder. It produced at first as rapid and complete a scattering as a shell could do fall-

ing among a group of soldiers; but whether they become familiar with the smell, abominable as it is, or disregard it in their eagerness for food, they are not long in returning, and proceeding as if nothing had occurred. I had greater expectations from the solution of assafœtida, which was fluid, rather thick, and somewhat adhesive; but though liberally applied, and on several different occasions to the same plants, I cannot affirm that it produced any beneficial effect at all of a permanent nature.

Soot was also tried with very little effect; when the plant is dusted with it too thickly, it loses its colour and shrivels up, as if scorched with fire.

A mixture of sulphur, soot, salt, lime, and assafœtida was employed as a top-dressing for a few drills, at first apparently with considerable effect; but that soon ceased, either from the noxious exhalations becoming dissipated in the atmosphere, or the substances being shaken off the plants.

Although the experiments above described were unsuccessful in attaining the desired object, I trust that they will not be regarded as uninteresting or unimportant. They were carried into effect under my direction by a careful and intelligent grieve, who felt much interest in the subject, and watched the results with great attention: the conclusions arrived at may, therefore, be confidently depended on. It is proper, at the same time, to observe that the past season (1859), when these experiments were made, was an unusually dry one, even for this, of late years become a very dry part of the country (Roxburghshire). It was therefore extremely favourable to the increase and activity of the insects, while it was in a similar degree unfavourable to the growth of the plants. Possibly the noxious scents of the substances used were less diffusive and more speedily evaporated in this comparatively arid and warm atmosphere than they would have been in ordinary circumstances, and therefore productive of less effect. The test was thus a severe one; and had these essayed remedies succeeded in such circumstances, they might have been expected not to fail in any. That they did not succeed, shows that they are not to be relied on in the very cases in which remedies are most needed. In ordinary seasons, when other conditions are unfavourable to the beetle, they may possibly co-operate with these in checking its ravages; and when seed treated with sulphur has been supposed to be a cure, it was probably to these concomitant circumstances that the effect was mainly owing. Much has been said respecting the keen and delicate senses of these creatures, by which they are so easily enabled to find out their appropriate food, "sagacious," like the carnivorous birds, "of their quarry from afar." But it is seen, from what has been recorded above, that it is in vain to seek to repel them by noxious smells, or even by tainting their food with some unsavoury taste; these either do not

produce the effects intended, or the effects are disregarded when the alternative is to deprive them of their favourite plant. Even if their fastidiousness with regard to smells be admitted to be great, their love of eating is evidently much greater.

These experiments, it is to be hoped, will have the effect of saving time, labour, and expense, in attempting remedies which, though often recommended, are likely to fail at the very time when the exigency is greatest. They show that a preventive must be sought for in some other direction. It may possibly be found in strewing the young turnip-plants with coarse dust, or particles of some hard and gritty substance, against which the insects' jaws, trenchant enough when employed on the soft pulp, are altogether powerless. And if this be made to adhere to the cotyledon and young rough leaves by some viscid substance, it will probably be difficult for the insects to make any impression. It is on this principle, it appears to me, that we must explain the effect of road-dust, which is said to have proved remedial on the Continent. And it is on the same account that I should be disposed to prefer the following composition, proposed by Mr Fisher Hobbs, of Boxted Lodge, in Essex—namely, 14 lb. of sulphur, 1 bushel of fresh lime, and 2 bushels of road-scrapings per acre—to that which he has been in the habit of using, and by which he affirms that he has saved his turnip crops from the Haltica for a considerable series of years. The latter consists of gas-lime, fresh shell-lime, sulphur, and soot. A somewhat similar composition (with the exception of the gas-lime, which is not easily procurable in rural districts) failed, as has been seen, in my hands. The sulphur used alone is evidently powerless, but the presence of lime may excite it to more energetic action.

It is perhaps also worth considering whether some active poisonous substance might not be employed with advantage. It is well known to insect-collectors that prussic acid and some other poisons speedily kill the largest and strongest moths; and chloroform acts upon all insects much in the same way as upon the higher animals. But, generally speaking, we are not well acquainted with the effects of poisons on these creatures. It seems, however, in no way improbable that a slight sprinkling of some such substance, while it would not deter the insects from eating a little of the plant, would lead to their own destruction.*

Although, as has been already stated, the increase of the Haltica has of late years been very great, especially in certain parts of the country, it will seldom happen in ordinary seasons, and still less in damp and cloudy ones, that it will cause an entire failure of the crop. The farmer need not be too hasty in taking alarm. Good

* A square of paper, covered with some chemical composition of a poisonous nature, is now in frequent use for destroying the common house-fly; and it answers the end most completely, as I can testify from my own experience of it.

cultivation, and especially abundant manuring, and a plentiful supply of seed, will enable the crop to withstand and outgrow very formidable attacks. Even when the seed-leaves are entirely consumed, and nothing but a naked stump remains, it does not necessarily follow that the plant will die. If the centre of the stem remains uninjured, the rough leaves will expand, and the plant spring, although for a time with retarded growth. This I ascertained by repeated trials. The proportion of plants necessary to form a full crop is very small, compared with the number of seeds committed to the soil. Still it is highly desirable that some means, *of general applicability*, could be devised for securing our turnip crops against this pest; and there is no reason to despair of doing so. For myself, I am gratified that I entered upon the examination of the subject, for I have been enabled to throw some new light on the natural history of the insect; and if I have not succeeded, notwithstanding considerable effort and some expense, in detecting any effectual remedy, I have at least shown where it is *not* likely to be found, and that certain approved applications, as well as some others of fairer promise, are inadequate to the object in view. I have thus at least narrowed the field of inquiry, and facilitated, I hope, the researches of others who may follow me in the same track.

RECLAMATION OF WASTE LAND ON SHEEP-RANGES.

By Laurence Anderson, Chapel, Moffat.

[Premium—The Medium Gold Medal.]

We remember the time when agricultural literature was in little repute; when to read a treatise on the subject was no ordinary trial of patience, and with some, was even no small offence to taste; when our farmers, the large and wealthy, received few advantages from education, were not conversant with the rules of their profession, were not aware that chemistry and geology had any connection with the cultivation of the soil, and who, in realising the false sentiment that "ignorance is bliss," cared little either for science or literature. Machinery, as applicable to agricultural purposes and improved implements of husbandry, was in a great measure in an infant state; and the drawing off of water from the earth, so as to fit it for grasses, corn, and nutritive roots, where the moss plant or the rush grew before, was little practised. The application of numerous manures to the soil, whereby a larger breadth of green crop is yearly raised; the giving of artificial food to sheep and cattle, by promoting the early maturity of stock, forms one of

the great modern sources of profit; the celebrated Cheviots of our national and local shows—stately in appearance, beautiful in shape, and luxuriant in wool—and the noble crosses and half-bred hoggs, are the results of recent times.

The feeding of hoggs has been most successfully prosecuted in Annandale. The show at Lockerbie in April, the management of which is deserving of all praise, has done much to improve and systematise the feeding of sheep. The animal occasionally is weighed in scales, so as to enable the feeder to know the progress it is making, and to experiment in the use of supplementary food, such as oilcake and oats—the live weight of the animal on the day of show being the test of superiority. This practical process, happily introduced and uniformly acted upon, has been of great use to the feeder. From a table of weights commencing in 1839, and which shows the progress of improved feeding, we make the following extracts:—

Average Live Weight of Twenty Half-bred Premium Hoggs at Lockerbie April Show.

1839,	115 lb.*
1841,	130 „
1844,	142 „
1846,	175 „

This is the highest range of weight. The average of the last sixteen years is 162 lb., corresponding to 88 lb. of mutton. Cheviot hoggs were first exhibited at Lockerbie in 1845, when much experience had been acquired in feeding. That year indicates 115 lb.; the present, 121 lb. Feeding in the fields has been the general practice. The secret of the great success attained consists in selecting lambs of superior breed and quality, storing and cutting turnips, giving cake and grain; above all, in attention and skilful management.

In this age of agricultural enterprise and industry, which the Highland and Agricultural Society of Scotland has nobly assisted in directing and fostering, the sheep-farmer has not been a mere on-looker. We can point to his improvement of the native sheep of the Cheviot Hills, peculiar in their natural state for their *brown heads and legs, high narrow backs, light forequarters, and ungainly look;* his drainage of land and his general management. It was only about the beginning of the present century that the Cheviot sheep, from time immemorial natives of the Cheviot Hills, were introduced into Dumfriesshire, and have now spread westward and northward, and penetrated almost every valley of Scotland. About the middle of last century, great attention was paid to the breed by the Messrs Robson of Northumberland, who crossed with the Bakewell ram, and greatly improved the appearance and character of the Cheviot sheep. Their

* This corresponds to 60 lb. of mutton.

tups were in general request, and to them Scotland is indebted for an improved breed. It is curious to know that the first Cheviots that crossed the Annan westwards were driven by the Ettrick Shepherd about the beginning of the present century, and located on Queensberry. At that time the stock of Moodlaw, now and so long celebrated, was blackfaced.

The drainage of sheep-land in Annandale—an important improvement, and generally left to the tenant to execute—is not expensive, as open sheep-drains are made at about one penny per rood of eighteen feet.

The reclamation of waste land on sheep-ranges is a subject which the Royal Agricultural Society of England has of late years pressed much upon the attention of its members. A high Scottish authority, Mr Stewart of Hillside, has called it "the greatest improvement, next to draining, in modern farming." In writing this paper, it is our object to expound this important subject, for in many localities it has been much neglected by the sheep-farmer. In the upper district of Annandale, the process of reclamation has to some extent been prosecuted; in particular, on the sheep-farm of Harthope, in the Evan valley, farmed by the proprietor, upwards of fifty acres have been ploughed, enclosed, limed, and sown with grass-seeds as a lambing park for the flock. We have not the means of estimating exactly the extent of waste land in Annandale which, with advantage and profit, might be reclaimed, either by once ploughing, liming, and sowing with grass-seeds, or liming on the green surface; but we believe it may be about 20,000 acres, all under an altitude of 900 feet. Fourteen years ago our attention was directed to the subject, and we broke up about five imperial acres of brown bent (*Agrostis canina*) on a hill in Upper Annandale, having a fine southern exposure. The elevation ranged from 700 to 800 feet above sea-level, with a moist climate, averaging 43 inches of rainfall annually. Our success, and the encouragement of an enlightened and liberal proprietor, Mr Hope Johnstone of Annandale, who offered to pay half the cost of lime, induced us to persevere, and we have now completed, in patches of 5 acres, nearly 70 acres, on an open sheep-range, being about one-eighth of the hill-land of the farm. The change from withered bent, not worth one shilling per acre, to fine pasture, the value of which may be safely estimated at twelve shillings, is very encouraging.

The district is geologically part of the great Silurian formation of the south of Scotland, containing as fossils many species of graptolites, not far from the farm to which these remarks apply. The Silurian rock, or greywacke, is often so dark-coloured and fine-grained, that in external appearance it resembles trap-rock so completely as to be generally mistaken for it by strangers. The soil operated upon is generally moss, about four inches deep,

with a slight admixture of earth, on a subsoil of hard till, and its natural production is bent, a coarse rough grass, which sheep only eat after moor-burning, when it is tender, green, and young. The ploughing, a slow process because of the toughness of the rooty soil, stones, and boulders, may be executed during a black frost. The plough requires to be fitted with a feathered sock, and, on sloping ground, ploughing down-hill is recommended. Each winter's tillage may be limed in early summer, on the completion of turnip-making, at the rate of 4 cartloads or 60 cwt. per acre, and grass-seeds sown and harrowed in. Though ryegrass be only used, white clovers and other natural grasses will spring up under the fertilising influences of lime and atmospheric action. It may be here stated that summer-fallowing, as practised by some, is not only expensive but injurious; and green cropping, which could only be attained by temporary fencing, we would in no case recommend. Such a soil, because of its extreme lightness, is injured by its constituent parts being separated and reduced to a consistence like peat-mud. Tenacity and solidity, preserved by once ploughing, are necessary for sustained production.*

In summer, sheep in great numbers flock to the newly-ploughed ground, scrape and leave droppings, which enrich the soil in a manner more advantageous than by green-cropping. The plan of breaking up in patches, and not in a continuous breadth, has much to recommend it. One of the natural habits of the sheep is, to seek for fine pasture in the morning, and draw to the uplands or coarser ranges in the afternoon. It is no uncommon circumstance for sheep, in the indulgence of their natural habit, to travel miles for a sweet morsel by the water-sides or in the green patches. This is fatiguing to the animal, and provision, so far as is possible, ought to be made to prevent this travel. Each *hirsel* of sheep has its *hefs*, or local divisions, and each *hef* ought to have its variety of food—its cultivated spot and upper fell. By selecting suitable places for breaking up—a patch on each local division—this can be, and in our case has been, attained. In the course of, say, twenty years, these reclaimed parts are likely to get fogged and unproductive, and a second application of lime must take place; but our first break, done fourteen years ago, is still fresh and green. Care

* We have found some enterprising and skilful sheep-farmers on the lighter soils of the valley of Yarrow, at an elevation of 900 feet, summer-fallowing, and thoroughly incorporating the lime with the mass of soil. In this case, however, there was no peaty stratum on the surface: when this occurs, as stated by the author of this report, and when there is till below, it is undoubtedly the best practice, as contended for, to keep the earthy soil entirely above the peaty matter. So also small doses of lime, say of three tons, are much more potent in their effects when kept on the surface, and not mixed through the body of the soil. In top-dressing peat lands, too, with sand or clay, which are to be sown with grasses and kept in pasture, it is a great saving of material to keep it quite on the surface. The plough should never be used after these dressings are applied. If the harrow is insufficient to level and soften the surface, the grubber will effect the end desired.—ED.

ought to be taken to select sloping dry ground for the operation, as on flats, where there is a superabundance of moisture, the rush and aquatic plants, productive of disease in sheep, are certain to rise. The effects of the improvement of bent land are—an increase in the number of sheep kept, say 8 per cent; less disease in the flock; a finer clip of wool; and lambs of much superior quality. A great saving in low pasture is effected by the sheep keeping their own local divisions or *hefs*, and not ranging from hill-top to water's edge. The improvement of stunted heather, which we have tried to a limited extent, is perhaps of as great importance as that of bent. The upper surface is a brownish yellow-coloured earth, lying on an open red subsoil. The depth is about 6 inches, with few stones to impede the plough. It has been subjected to the same process as bent land, with the addition of 20 cwt. more lime per acre, the depth and weight of soil requiring that quantity.

It has occurred to us that the experiment of taking a crop of potatoes before sowing down with grass-seeds, might be made. One advantage certainly would be the renovation of the potato, and fitting it more peculiarly for seed, for its sprouting powers have been much injured by planting in rich soils. This has fitted it for the table, but injured its vegetative powers. The green and watery growth of an upland virgin soil produces in the fertile valley a crop more abundant and less diseased. In this case fallowing would be necessary, the first ploughing remaining untouched for at least nine months, exposed to atmospheric influences The soil being unmixed with clay will be easily broken up, and prepared for potato husbandry. Instead of farmyard dung, which is needed for the lower grounds, guano may be used at the rate of 4 cwt. per acre.

In the south of Scotland there are many sheep-farms, with ridges under an altitude of 1000 feet, admirably adapted for such experiments. The effects are more apparent on flocks producing half-bred lambs, but there can be no doubt that the Cheviot breeder would be much benefited.

Expense of reclaiming bent land per imperial acre:—

Ploughing, ...	£0	10	0
Harrowing, . . .	0	2	0
Lime, 4 cart loads or 60 cwt, . .	1	8	0
Carting of lime, say 3 miles, . . .	0	7	0
Grass seeds, ...	0	3	0
	£2	10	0

realising on the outlay, according to the difference in the value of land—namely, 11s. per acre—22 per cent.

In addition to the improvement of bent and stunted heather, we have limed a considerable extent of dry light land on the sheep-range, which many years ago had been under tillage, and was

fogged and unproductive. The quantity of lime applied to the surface was ten cart-loads per acre, and the effect was manifest by the fog disappearing, and the finer grasses springing forth thickly and luxuriantly. We prefer this mode to the plan, commonly adopted, of enclosing, breaking up, putting through a course of cropping, and sowing out with grass-seeds. The exhaustion of soil consequent upon the production of two grain crops is great, the reduction of its adhesiveness injurious, and the pasture soon gets thin and fogged, requiring a repetition of the process. In the middle or south-eastern district of Annandale, liming on the surface has long been, and still is, much practised. The first great experiment was made nearly half a century ago on the farm of Torbeckhill, where lime was applied to bent, bog, and dry hill-pasture, which the plough had never penetrated. The effects were quite extraordinary, and are visible to this day. Others followed the example so worthy of imitation, and the farms of Dunnabie and Paddockhole may be mentioned as proofs of the success of the experiment. The stock kept on these farms before the improvement was effected was of an inferior description—poor Cheviots and small Galloway cattle; now, superior half-bred lambs are raised, averaging about 10 lb. per quarter, and Galloways of the first class.

The Caledonian railway has given great facilities for the improvement of land in Annandale, and the traffic in lime, arising from its application as a top-dressing, is increasing rapidly. In 1854, the quantity carried to the different stations was 6000 tons; last year it was 13,000, about three-fourths of which were laid on permanent grass-land, covering a surface of 1400 acres. Mr Hope Johnstone of Annandale, and Mr Jardine of Corrie—the latter of whom is expending large sums in enclosing, draining, and liming, for the purpose of establishing productive dairies—are proceeding on an extensive and systematic scale. On both these estates the proprietors pay the half of the cost of lime, and tenants readily avail themselves of this encouragement.

In the vale of Clyde, in the vicinity of Abington station, there are extensive ridges showing marks of early cultivation, which are fine subjects, with all the necessary facilities, for the improvements which we have been treating of; and the pastoral valley of the Yarrow, with its wide fields of unproductive bent, cannot fail to suggest itself as a subject for the enterprise of the improver of hill-pasture.

ON THE COMPARATIVE FATTENING QUALITIES OF PURE AND CROSS-BRED SHEEP.

By JAMES B. BIRD, Fishwick, Berwickshire.

[Premium—The Gold Medal.]

IN experimenting with pure and cross-bred sheep with the view of ascertaining their comparative feeding and fattening qualities, the writer, on consideration, thought it would be most satisfactory to do so with animals verging on the age of maturity. Accordingly, twenty wethers—viz., five Leicesters, five Cheviots, five half-breds, and five twice crossed, all in their second year—were selected for the purpose.

The Leicesters were purchased from a gentleman in the immediate neighbourhood, bred by himself as the purest blood; the Cheviots and half-breds from Mr Murray, Longyester, near Gifford, who breeds all his own stock, consequently they were out of the same flock of ewes; the half-breds being got by Leicester tups, also bred by Mr Murray. The twice-crossed were bred and reared on the farms with which the writer was connected (the experiment being conducted during winter '58 and '59), being the produce of half-bred ewes and Leicester tups—the ewes themselves a cross betwixt the Leicester and Cheviot, the tups purchased as some of the best blood in the county.

The five Leicesters were purchased and brought on to the ground on the 21st, the Cheviots and half-breds previously, on the 15th October 1858. All were retained on grass till the 28th, when they were folded on white turnips, on which the twice-crossed sheep had been for nearly a month before. On the 13th November all were correctly weighed, each lot of five, as described, being then put into separate enclosures, and treated exactly alike, as immediately to be detailed. When thus put up to feed, they, to appearance, seemed very much upon a par as to progressing healthy condition—all having thus a fair and impartial commencement.

The enclosures were formed against a stone fence, sheltering all the sheep equally well from the north-east, they being very well protected from blasts and stormy weather from other directions by hurdles and straw being fitted up together, so as to form for them a desirable and welcome retreat, which they not only used in such weather, but to which they very generally retired at night even in ordinary weather, the bedding of straw seemingly being to them an inducement in preference to the cold, wet, or damp ground. Each enclosure was 15 yards in length by 9 in breadth. The turnips selected for their use were procured from part of a field of swedes, where the crop, as to size and quality, seemed

very much alike. So many drills were allotted to each lot of sheep, so that the exact amount of turnip-land cleared by each might at the last be ascertained by measurement.

For a few days at first all of the lots had the swedes, after being topped and rooted, given to them whole in troughs, in which state they ate them easily and readily enough, only the Cheviots proved too nice to eat the crowns, as well as some of the inferior portions of the bulbs, and therefore it was thought advisable at once to resort to Gardiner's cutter. Cut swedes, then, of the very best quality, stored in good condition during favourable weather, formed their chief food from 13th November, when the trial commenced, till the 16th March, when it terminated, exclusive of a daily allowance of oats during the last five weeks. Great quantities of the straw, put in hurdles to afford them shelter, was used by them, which was again and again replaced, but no account kept of the amount that was consumed by each lot, it being thought an item of trifling consequence—all seemingly eating and relishing it equally well. Without a single exception, they were all also remarkably fond of the oats.

For the first eight weeks or so, the Leicesters, Cheviots, and half-breds fed as regularly as could be desired. The twice-crossed, too, although feeding regularly enough, seemed more easily satisfied at first, their appetite, however, gradually increasing towards the close of the experiment. For the last nine weeks the appetite of the Leicesters for turnips steadily declined, till, near the end, they scarcely used the one half consumed by either of the other lots, though always very ready for their oats, and fond of eating straw. To the very last the Cheviots and half-breds preserved their appetite unimpaired. All were weighed correctly a second time on the 10th of January 1859, and again, for the third and last time, on the 16th March, when the experiment terminated. The Cheviots and half-breds being sold, two or three days afterwards, to a butcher at so much per pound dead weight of mutton, the writer saw them killed, dressed, and weighed himself, noting particularly the individual weight of each sheep, to see how it tallied with the live weight, according to a given rule amongst sheep and cattle dealers—viz., for every 14 stones of live weight of well-fed mutton, 6 must be deducted as offal. He at the same time saw, also for himself, the tallow of the two lots correctly weighed, an account of which is also given in the statement of result.

Each sheep at first having received its own distinguishing mark, the writer is thus enabled to show the exact weight gained by each during the time of the experiment.

TABLE

STATEMENT showing the Result of the Experiment on each Sheep individually, as well as on each Lot of Five as a Whole.

		Weight of each Sheep, November 18, 1858.	Weight of each Sheep, January 19, 1859.	Amount of weight gained or lost by each sheep for 57 days' feeding. Gain.	Amount of weight gained or lost by each sheep for 57 days' feeding. Loss.	Quantity of turnips consumed by each Lot for 57 days' feeding. Crop about 18 tons per acre.	Weight of each Sheep, March 16, 1859.	Amount of weight gained or lost by each Sheep during 65 days' feeding. Gain.	Amount of weight gained or lost by each Sheep during 65 days' feeding. Loss.	Quantity of turnips consumed by each Lot during 65 days' feeding. Crop about 18 tons per acre.	Weight of oats consumed by each Lot during the last 65 days' feeding.	Amount of weight gained by each Lot during the 57 and 65 days' feeding combined, forming as a whole 122 days.	Weight of Mutton and Tallow in Lots 3 and 4—Cheviots and Half-breds—after being killed and dressed under the inspection of the writer. Weight of Mutton.	Weight of Tallow.
		stones. lb.	stones. lb.	stones. lb.		square yards.	stones. lb.	st. lb.	st. lb.	square yards.	lb.	stones. lb.		
Leicesters.	No. 1,	10 8	11 8	1 0	...	708	10 10	...	0 12	512	128	...	...	...
	... 2,	11 4	11 6½	0 2½	...	...	11 3½	...	0 3	...	...	...	...	...
	... 3,	10 10	11 8	0 12	...	...	12 1½	0 7½	...	...	...	...	...	...
	... 4,	10 1½	11 0½	0 13	...	...	11 6	0 5½	...	...	..	...	...	...
	... 5,	9 0	9 9½	0 9½	...	...	10 3½	0 8	...	...	...	...	...	...
		51 9½	55 4½	3 9	...	708	55 10½	1 7	1 1	512	128	4 1	...	...
		stones. lb.	stones. lb.	stones. lb.	st. lb.	square yards.	stones. lb.	st. lb.		square yards.	lb.	stones. lb.		
Twice-crossed.	No. 1,	9 10	10 9	0 13	...	606	11 10	1 1	...	689	128	...	...	...
	... 2,	10 3	10 0½	...	0 2½	...	11 7	1 6½	...	...	...	...	...	...
	... 3,	9 7½	9 10½	0 3	...	...	10 2½	0 6	...	...	...	...	...	...
	... 4,	10 6	11 4½	0 12½	...	...	12 5½	1 1	...	...	...	...	...	...
	... 5,	10 8	10 5	...	0 3	...	11 6½	1 1½	...	...	...	...	...	...
		50 6½	52 1½	2 0½	0 5½	606	57 3½	5 2	...	689	128	6 11	...	...
		stones. lb.	stones. lb.	stones. lb.	st. lb.	square yards.	stones. lb.	st. lb.		square yards.	lb.	stones. lb.	st. lb.	st. lb.
Cheviots.	No. 1,	9 10	10 4½	0 8½	0 2	636	11 6	1 1½	...	664	128	...	6 2	...
	... 2,	9 10½	9 8½	...	...	...	10 1	0 6½	...	...	...	...	5 6	...
	... 3,	9 10	10 9½	0 13½	...	...	11 11½	1 2	...	...	...	...	6 7	...
	... 4,	10 10	10 12½	0 2½	...	...	11 11	0 12½	...	...	...	...	6 10	...
	... 5,	10 3	10 9	0 6	...	...	11 8	0 13	...	...	...	...	6 3	...
		50 1½	52 2	2 2½	0 2	636	56 9½	4 7½	...	664	128	6 8	31 0	4 1½
		stones. lb.	stones. lb.	stones. lb.		square yards.	stones. lb.	st. lb.		square yards.	lb.	stones. lb.	st. lb.	st. lb.
Half-breds.	No. 1,	9 7	10 4	0 11	...	744	12 1	1 11	...	673	128	...	6 12	...
	... 2,	9 11½	10 2½	0 5	...	...	10 12	0 9½	...	...	...	...	6 4	...
	... 3,	10 3½	10 12½	0 9	...	...	12 5½	1 7	...	...	...	...	7 0	...
	... 4,	10 3½	10 11½	0 8	...	...	11 11	0 13½	...	...	...	...	7 0	...
	... 5,	10 3	11 10	1 7	...	...	13 9	1 13	...	...	...	...	7 10	...
		50 0½	53 12½	3 12	...	744	60 10½	6 12	...	673	128	10 10	34 12	4 7

At first sight, perhaps, the statement of result may appear incomplete, showing, as it only does, the comparative amount of weight gained by each lot during the time of the experiment, without its being calculated at so much per lb., and the comparative amount of profit or loss in money shown. Such, however, has been no overlook or neglect on the part of the writer. He has omitted doing so, because he feels the difficulty exists as to what such gain in weight should really be calculated at. Doubtless the weight gained by sheep or cattle during the period of their feeding and fattening is not all in mutton or beef, but partly in offal; and regarding it only in this light, the writer at one time was of the opinion that a deduction ought to be made for such. Such opinion, however, has since been shaken, by the consideration of the fact, that although the gain in weight during a period of feeding by a lean or half-fat animal must be regarded as what it in reality is, partly offal, the carcass, as a *whole*, becomes so much enhanced in quality during the same period, and by the same food, as not only to justify the whole amount of weight gained being calculated at full money-rates of market value without any deduction for offal, but even in some cases a little addition to such—such as when the stock fed and fattened are at the commencement particularly thin. Weighing the matter thus, and thinking that difference of opinion as to such might also exist amongst others, he thinks better, as to this experiment, to leave practical men to calculate the amount of weight gained at what they think proper according to their own opinions, especially as a very definite conclusion may be arrived at, judging from the comparative gain of weight alone; the quantity of oats consumed by each lot being exactly the same, while not a great deal of difference is shown in the quantity of the turnips.

Allowing the result of the experiment on each sheep singly to speak for itself, and commenting on each lot of five as a whole, the writer would direct attention to No. 1, Leicesters, during the first 57 days' feeding, having consumed 708 square yards of turnips, and gained in weight 3 stones 9 lb.; to lot No. 2, twice-crossed, 606 square yards, and gained, after deducting 5½ lb. loss, 1 stone 9 lb.; to lot No. 3, Cheviots, 636 square yards, against an increase of 2 stones ½ lb., deducting 2 lb. of loss; and to lot No. 4, half-breds, 744 square yards, and gained 3 stones 12 lb. additional weight.

Although, as now shown, the turnips used by lots 2 and 3 were a little less in quantity during the 57 days' feeding than what were used by lots 1 and 4—consequently, calculating turnips, say about £7 per acre, a trifle less against them as to expense—the much smaller amount of weight gained in mutton will not allow them to stand a comparison with the latter Nos. 1 and 4, Leicesters and half-breds, which may, taking the very near equality in

the amount of food consumed and increase in weight, be regarded as very near upon a par with each other.

At the termination of the last 65 days' feeding, lot No. 1, Leicesters, shows a very marked decrease in its consumption of turnips, 512 square yards only having been used; while the additional weight acquired was even comparatively smaller—just 6 lb.; lot No. 2, Twice-crossed, shows a consumption of 689 square yards for the increased weight of 5 stones 2 lb.; lot No. 3, Cheviot, 664 square yards. for 4 stones 7½ lb.; while lot No. 4, Half-bred, in return for 673 square yards of turnips consumed, gives the very superior increase of 6 stones 12 lb. more weight; each lot consuming besides, 128 lb. oats.

For the whole 122 days' feeding, the result exhibits, as to lot No. 1, Leicesters, an increase in weight of 4 stones 1 lb., against the consumption of 1220 square yards of turnips; lot No. 2, Twice-crossed, 6 stones 11 lb., against 1295 square yards; lot No. 3, Cheviots, 6 stones 8 lb., against 1300 square yards; and lot No. 4, Half-bred, 10 stones 10 lb., for 1417 square yards; No. 4 having thus gained in all nearly 4 stones more weight than either of the others, in return for little above 100 square yards more turnips consumed, which undoubtedly assigns the superiority to the half-breds in this experiment as to the comparative qualities of fattening and increase of weight.

It must, however, be borne in mind, that as the Leicesters, lot No. 1, did not eat so regularly and plentifully as they might have done—for several weeks before the close getting apparently discontented both with food and confinement, some of them, in consequence, even losing considerably in weight—the result of the last 65 days' feeding with them cannot be regarded as any conclusive comparative criterion to go by whatever, though the trial with them against the other breeds during the first 57 days may be viewed as a very fair one. The Twice-crossed, lot No. 2, as gaining 3 lb. more weight during the full period of the experiment than lot No. 3, on a smaller quantity of turnips, must be owned as standing second to No. 4.

But the writer, while commenting impartially on all, thinks proper specially to call attention to the trial with the Cheviots and half-breds as being exceedingly satisfactory, and the one on which greatest reliance may be placed as of real practical value—both lots being not only, on the mother's side, of the *same blood*, but bred and reared on the same ground, thus making them greatly more valuable as subjects for an experiment such as now detailed. It was this consideration which partly prompted the writer to carry out the experimental test with them to the latter, and see them killed and dressed himself, so that the correct weight of mutton and tallow, as well as the quality of the former, might be ascertained. And well did all of them kill: several slaughter-

ers were assisting, and all expressed their admiration, especially at the hind legs of the Cheviots. "Such mutton," said they, "was rarely killed in Berwick." And although the mutton of the Cheviots was most admired, as being thought more likely, judging from the taste of the public at present, to find a ready sale, yet the half-breds, as to comparative weight in mutton, again proved their superiority by nearly 4 stones more than the latter, besides a few pounds more tallow. Taking it as a proportional question, according to the respective live weight of each, the Cheviots, had they killed as well as the half-breds, ought to have produced nearly one and a-half stones more mutton than they actually did. And yet, conclusive as this may seem, the writer cannot think but that it would require a series of like experiments made, ere judgment could be pronounced finally in favour of feeding half-bred sheep at all times, and in all circumstances, in preference to Cheviots. So much is due to what is termed "a difference of blood" in stock of all varieties, that although the experiment in this case has proved itself a very marked one in favour of the half-breds, in all probability, were a few more like experiments conducted with sheep selected from various flocks, some might result in favour of the Cheviot.

A difference, too, of food, soil, situation, or altitude, may each, separately or combined, be the means of causing anomalous and unexpected results in the feeding and fattening of different breeds of sheep-stock especially. It is not *invariably* the best of food and shelter that will do if something else is awanting. Witness the result in this experiment as to the Leicesters. Cheviots are Cheviots wherever they may be met with; likewise Leicesters and every other breed. Each and all, if pure, will present the same distinguishing features in their general tastes and habits, as well as appearance; and yet, strange to say, what is bred by one may be found not to feed and fatten so well, whoever gets them, as those bred by another. So much for a difference not of breed, but of blood, creating, as it visibly does in all species, a greater or less inherent propensity to grow, feed, and fatten—a propensity hereditary in its nature, and so transmitted from one generation to another. As already hinted at, climatic influences produced by soil, situation, or altitude, may, and in all probability do, exert a powerful effect, either salutary or deleterious, towards the feeding of the different breeds of sheep. Thus, results that were obtained, as in this experiment, on a dry soil, with plenty of shelter, at, by Government survey, an altitude of 500 feet, might have been very different on a poor, wet, exposed piece of moory land at an elevation of 700 or 800 feet; or again, on the deepest, richest soil, thoroughly sheltered, and at the height of 200 or 300 feet above the level of the sea.

Management, too, as most will allow, tends very much either to

the successful or unsuccessful results in sheep-feeding. Thus, with advantages every way the same, one man may make more, or at least as much, of what is generally regarded as a secondary breed or class of sheep, than what some of his neighbours make of the most approved. This applies more especially to stock-feeding on the same farm on which they have been bred. So, possibly, a good deal may depend on the farmer, farm, and stock having been for some time accustomed to each other. Thus, from a variety of unpropitious circumstances and unfavourable occurrences for a time clashing with each other, sheep of a certain breed may be found to succeed so badly as to prove almost unprofitable, but which, when persevered with, may turn out to be the very reverse, responding liberally to the most sanguine expectations.

Such being a very few ideas as to sheep-culture—not indeed peculiar to the author, but prevalent, he is fully persuaded, amongst, and thoroughly appreciated by, the greatest proportion of those who have had experience in the breeding and feeding of sheep—the writer feels it would be unfair in him claiming especial attention to what he has termed "A Satisfactory Experiment as to the Comparative Feeding and Fattening Qualities of Cheviot and Half-bred Sheep," without stating fully everything, in his opinion, that may and does detract from its really practical value, and cause it to be doubtfully regarded and cautiously relied upon as being under all circumstances a sure basis on which to build sanguine expectations as to the remunerative results from any peculiar breed of sheep, compared with others, when annually and extensively put to the test in whole flocks feeding in the ordinary way in the field. A series of experiments, such as the one now reported, on different soils, &c., and subject to the opposing influences just noted, can alone give reliable results on which to ground an extensive practice, without the risk of loss and disappointment. The writer concludes, then, with the hope that others may begin where he has left off, and lend their assistance in throwing a little more light, in the shape of practical proof, on this department of agriculture—a department which is more and more every year proving itself to be, with all kinds of sheep, one of the most remunerative.

NOTE.—These experiments are interesting and valuable so far as they go. If the same number of sheep, of the different breeds experimented upon, had been fed together in the open fields, and the weights of the individual sheep ascertained, some striking facts might have been elicited. When sheep are confined in pens or enclosures, they always, as in these experiments, progress very unequally. This we found to be invariably the case in feeding sheep in sheds. Being in a great measure necessitated to feed all our sheep in sheds at Kilwhiss, we have found that while some of the Cheviot breed would gain fully 2 lb. in live weight weekly for about six months, others in the same pen were comparatively stationary. In experiments on feeding it gives greater precision to results if the exact weights of turnips are given. At present our data are still somewhat imperfect for ascertaining and discussing the profit or loss arising from feeding stock on turnips.—ED.

ON THE ECONOMICAL CULTIVATION OF ITALIAN RYEGRASS.

By JAMES FULTON, Temple, Maryhill, Glasgow.

[Premium—The Gold Medal.]

Introductory Remarks.—Vegetation is controlled by climate, yet the agricultural character of a country is always indicated by its cultivated plants. Every new plant brought within the sphere, and fitted to fill a place in our rural economy, is equivalent to a new element; in short, our plants make our agriculture. Notwithstanding the encouragement afforded by the amelioration of our laws, the stimulus supplied by commerce and manufactures, or the command which the improvements of science and discovery have given the farmer over the productive powers of the soil, what would our present agriculture have been but for the introduction of new and useful plants?

As the discovery of a new plant may revolutionise our agriculture, and as the vegetation of a large portion of the globe is as yet but cursorily examined, we may still look to the economic botanist as the accredited pioneer in cultivation for some of the greatest advances it is likely to make.*

The most important of late additions to the list of our cultivated plants is Italian ryegrass, the cultivation of which, owing to its valuable properties and admirable adaptation to the economy of the farm, is highly calculated to raise and enrich our agriculture.

The botanical character and interesting history of the introduction of this plant do not come within the design of this report, but they are fully given in the *Transactions of the Highland Society* and *Quarterly Journal of Agriculture*. None of our agricultural plants, according to the history of their cultivation, has made such rapid progress as the one under notice; yet its culture is far from being so general and extensive as its usefulness merits.

The economic culture of a plant, however valuable its properties, can only be partially realised until we arrive at a proper knowledge of its habits. It is hoped the report now submitted—the result of many experiments, and more than twenty years' observation—may be the means of extending the boon it will confer on all who may judiciously engage in its cultivation.

Properties and Qualities.—Like most plants fitted for the support, or which minister to the comfort or luxury of man, Italian ryegrass has a wide artificial range, flourishing in hot and cold,

* Our great agricultural societies might advantageously follow the example of the London Horticultural Society, by sending out botanists on exploring expeditions.

and in moist and dry climates. When placed in favourable conditions, it is remarkable for vigour and rapidity of growth. In Scotland it has been known to grow 1½ and in England 1¾ inches in a day. It vegetates at low temperatures, furnishes herbage and green forage both late and early in the season, and maintains throughout the year a verdure which gives to nature the cheering and enlivening aspect of perpetual spring.

Live stock of all kinds prefer it, as herbage, green forage, or as hay, to every other known plant. As a proof of its sweetness, it may be noticed that, when given mixed with clover, horses and pigs will pick it out and leave the clover; and when part of a pasture-field is exclusively sown with it, the preference evinced for it by stock furnishes a striking instance of the unerring instinct with which animals are endowed in the selection of their food.

Neither is it inferior in active qualities. Horses at hard and even fast work have for months been almost wholly sustained by it; and for the feeding of young cattle and pigs it is unrivalled. Stock fed on it likewise thrive well, and keep remarkably healthy. Not only so, but, like lucerne with the ancient Romans, Italian ryegrass is highly esteemed as food for invalid or sick animals. In pastures it forms a valuable constituent, and is found, on the average of soils, to be as permanent as the common perennial ryegrass.* Owing to the fresh herbage it yields in the spring and winter months, it is especially valuable for sheep. Producing late and early cuttings to the scythe, it is still more valuable as green forage, and should form the principal grass in every field intended for hay.

"It is remarkable that, for all the vast importance attached by the Romans to lucerne, its cultivation has been so entirely superseded by Italian ryegrass that not a single plant of it is now to be seen." †

It is, however, its capabilities of utilising liquid refuse, by converting it into herbage of the choicest kind, and thus, through the energy of its absorptive and assimilative powers, supplying a desideratum in our rural economy, that give to Italian ryegrass its deservedly high importance. As a utiliser of refuse liquids, it has given a satisfactory solution of the sewage question for several towns—is capable of doing the same for many more; and it has entered as a material element into the successful cultivation of small croft or spade-husbandry farms. It gives to the farmer a new and valuable resource; and shows, where its cultivation is brought to per-

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* Italian ryegrass is in little esteem as a pasture-plant on dry or inferior soils. It spindles up, and does not spread out and thicken below. Other grasses soon take its place. The preference which stock have to the plant no doubt assists in extirpating it when sown for pasture. The plant, indeed, is greedy of moisture and manure, which are both essential to its full development.—Ed.

† *Dictionary of Greek and Roman Antiquities*, Art. "Agriculture," New Edition.

fection, how the powers of the soil may be increased, and how small farms may be converted into considerable occupations, by a more perfect system of reproductive economy. When dressed with fertilising liquids, its capabilities for producing luxuriant and successive cuttings of rich, fresh, and succulent grass, eminently suited for the soiling of all kinds of live stock for six or seven months of the year, are so astonishing, that reports of it have sometimes been regarded as fabulous. If it be true that Hartlib, Blythe, and Tull laid the foundation of British agriculture by the introduction of root and forage plants, what admiration would fill the breasts of these enlightened pioneers could they witness the amazing crops of rich and luscious herbage which Italian ryegrass produces when fed with liquid-manure!

Valuable on every farm, its cultivation is peculiarly adapted to the dairy husbandry, owing to the refuse liquids that may be utilised, the wholesome nature of the grass, and the favourable influence it has on the quantity and quality of the milk.

In its native districts of Northern Italy, celebrated for the manufacture of Parmesan cheese, over the greater part of the year forced Italian ryegrass forms the chief food of the dairy cows.* The value of this grass, for dairy purposes, was fully established in Scotland more than twenty years ago by the late George Gunn, an enterprising and extensive dairyman of Edinburgh, whose dairy produce was famed all over the city. He grew it for many years on a field near Stockbridge, applying to it the liquid from his byres. One of the family, who took an active part in the management, told the reporter that, as compared to Italian ryegrass, "the Edinburgh meadow-grass was far inferior," and "that, when fed on Italian, the cows were maintained in milk and condition with less cake and meal than when fed on the meadow-grass, or on common ryegrass and clover." This observation is borne out by analysis. According to the result of the investigation by Professor Way, Italian ryegrass contains 2.48 per cent more nutritive matter, and 2.09 less of indegestible woody fibre, than a mixture of common ryegrass and red clover, rendering it not only more nutritive, but easier to digest and assimilate.

In one recorded instance, where the Italian ryegrass was manured with diluted stable urine, the produce of an imperial acre in one year was found to yield as much nitrogen as is contained in from 200 to 300 bushels of wheat. The researches of Professor Anderson have likewise made us acquainted with the fact, which may have a practical application, that the percentage of nitrogenous matter

* Italian ryegrass is a most valuable plant on the arable lands of Northern Italy: there, however, it is chiefly so on those irrigated lands that are under a rotation. The permanent meadows, which are extensive, are stocked with an admixture of grasses, and receive a large part of the liquid-manures.—ED.

is largest in the early, and the carbonaceous in the more advanced stages of its growth.

Land and Preparation.—Readily adapting itself to almost every variety of cultivated soil, Italian ryegrass is nevertheless sensitive to superior cultivation, which so far modifies and subordinates unfavourable conditions of climate as well as soil. It succeeds best on fine clean deep loams free from stagnant water, but possessing considerable powers of absorbing and retaining moisture. Land intended for its culture should be either naturally or artificially drained, and it ought to be deeply stirred, finely pulverised, freed from root or perennial weeds, and receive such enriching applications as will ameliorate the texture of the soil.

When intended for cutting, the surface should be made smooth and level. Where the supply of liquid fertilisers is limited, a liberal application of well-made dung or other organic matter, such as composts of moss or other vegetable substances, will not only enrich the soil, but increase its absorptive and retentive powers; and on thin, dry, or hungry soils deficient of moisture, the addition of 40 or 50 bushels of ground bones per acre will have a capital effect.

ANALYSIS OF THE ASH OF ITALIAN RYEGRASS.

	In Flower	In Seed.
Silica,	59.18	60 62
Phosphoric acid,	6.34	6.32
Sulphuric acid,	2.82	1.31
Lime,	9.95	12 29
Magnesia,	2 23	2 64
Peroxide of Iron,	0.78	0.30
Potash,	12 45	10.77
Soda,	3 98	0 13
Chloride of Sodium,	2 27	5.58
	100 00	99.96

Seed.—The first and most important point in the growth of all plants is the seed; on it success chiefly depends. The want of knowledge in regard to the proper kind of seed has, perhaps, more than all others, operated against the increased cultivation of Italian ryegrass. In any report, therefore, on its cultivation, the question of seed must claim primary consideration.

A very large proportion of the foreign-grown seed does not vegetate. The quantity recommended to be sown by seedsmen is often too small: thus many farmers, on their first trials, have found it planted so thinly on the ground, that they either dropped its cultivation as unsuited to this country, or did not sow it again for many years, or did so less extensively than they would otherwise have done.

Much of the foreign seed, it is evident, has either not been matured, or has lost its vitality by having been long kept, or by bad management. In the selection of seed, the safest guide, both in regard to quality and variety, is dealing with intelligent and experi-

enced seedsmen, as colour and smell, which are the popular indications of freshness, are sometimes defective. The circumstances of soil and climate, weather, and season of ripening, a heavy and light crop, change the appearance of the seed. Neither is weight per bushel a criterion of vitality, although a certain weight is proof of its having been matured, and, if sound, it is a guarantee that it will produce vigorous plants. The average weight of home-grown Italian ryegrass seed is from 16 to 18 lb. per bushel, but when fully ripened in fine weather a weight of 24 lb. is sometimes obtained.

To test the vitality and vegetative energy of different kinds of Italian ryegrass seed, the reporter made a number of experiments with equal measures of various samples of different weights, and found that, when of the same year's growth, and equal conditions as to dryness and state of preservation, the heaviest seed made the quickest, thickest, and most vigorous braird.

With a view to determine the relative value and quantities requisite for an acre of home and of foreign grown seed, a series of experiments, extending over a number of years, with a great many samples of Italian, French, English, Irish, and Scotch growth, were made by the reporter. The results of these experiments were as follows:—3 bushels of the best, or 4 bushels of average quality of English, are sufficient to sow a Scotch acre, or from 65 to 70 lb. for the Scotch, and from 52 to 56 lb. for the imperial acre; that from 5 to 5½ bushels of the best French, and from 7 to 8 of the best Italian-grown seed, are required to produce an equal number of plants; and, further, that the home-grown English is decidedly superior, although the French is a very fine, free, and large grower, but it is more expensive and less certain. The Scotch and Irish are equal to the English in number of plants, but they are a day or two later in coming into ear. Seed of a superior quality, however, may be produced in Scotland by employing the finest French or English for stock seed, and by allowing it to ripen in the most genial time of the year. As seed is influenced by the conditions under which it is produced, a habit of vigorous growth would be obtained by growing it in the most forcing season. We accordingly find that when two crops of seed—which Italian ryegrass readily yields—are saved in the year, that the seed ripened in August will be 2 lb. heavier per bushel, and have a shorter awn, than seed from the same plants ripened in the month of June.

The Italian-grown seed used in these experiments, and on which the foregoing conclusions are founded, was the best imported, being supplied by a most respectable firm who has an agent at Leghorn for selecting and cleaning it. A large proportion of the Italian seed imported from Leghorn and Trieste will produce little more than twenty plants out of a hundred seeds. The imported Italian likewise produces more slender and delicate-looking plants than the French or the improved varieties of the English. It is supposed

by some that plants from the Italian-grown seed carries more side foliage, but the true explanation of this supposed habit will be found in its thinner planting on the ground.

The best samples of English-grown seed used in these experiments were procured from Joshua Rodwell, of Alderton Mains, Suffolk, and from William Dickenson, Curzon Street, Mayfair, London, both of whom communicated papers on improved varieties to the Royal Agricultural Society; and a sample from Alexander Cross & Sons, seed-merchants, Glasgow, out of stock they annually receive from a celebrated grower in Cambridgeshire. These three samples, and the best French, which were supplied by the Messrs Cross & Sons and the Messrs Lawson of Edinburgh, exhibited the same habits, and were almost identical in their botanical characters; the principal features of which, as compared with imported Italian, are the larger size of the spike, and greater number of florets in the spikelets, which render it much more prolific. They admit, however, of being further distinguished, as *L. Italicum*, var. *rubra*; and *L. Italicum*, var. *alba*.

Lolium Italicum being very fertile in the production of varieties, superior kinds, having different adaptations and properties, may yet be obtained by selection and cultivation. It is now a settled question that this plant does not degenerate in England; indeed, it is affirmed by travellers that the home-grown crops surpass anything of the kind ever witnessed in Italy. In saving seed, growers would do well to ripen it so that it might weigh at least 18 lb. per bushel, and defer thrashing it out till near the time of sowing.

Sowing.—To insure regular planting, this operation requires to be methodically and nicely performed. When the seed is to be sown by the hand, it is necessary to have the land, which is laid flat to facilitate cutting and watering, marked out into proper divisions, as a guide to the sower. Divisions laid out in the direction of the wind, 14 feet wide and sown with three casts, have been found to answer very well.* The divisions may be very simply marked off. Having obtained a straight line to commence with, two persons take a rope 14 feet in length between them, one of them as a guide walks along the line, and the other, with a hoe or pole marking a parallel line, walks at the other end of the rope, the guide always keeping on the last-made line, and so on. The seed is perhaps best covered by a single tine of a pretty effective close-tined harrow. When the surface is dry, a light roller should finish the operation.

Cultivation.—The most economical plan to adopt for the culti-

* Three casts may appear too many for 14 feet, but this is sound advice; if it is an error, it is certainly on the safe side. When grass seeds are sown with the hand, the operation is often badly done; this arises almost invariably from the casts being too wide. In the ordinary sowing of grass seeds, in no case should the casts be wider than 6 feet. When this is attended to, there is little danger of imperfect distribution.—ED.

vation of Italian ryegrass, is to set apart for the purpose a piece of land near to the farm-steading, so as to be convenient for getting the grass and conveying the liquid. Should there be any part of the land so situated as to admit of the liquid being applied by gravitation, it should be selected.

Being so productive, a comparatively small piece of land is required; but the extent will depend on the mode of culture resolved on. It can be successfully grown either on a two-shift of one and two years' grass; on a three-shift of one and two years' grass, and a drilled green crop; and on a four-shift of one year's grass, a corn crop, a drilled green crop, and then a corn crop again.

It ought to have been premised that, although in pastures Italian ryegrass endures for a number of years, the period of its profitable occupation of the land, without being renewed, when highly stimulated and frequently cut, seldom exceeds two years, as the plants not only fail, but the land becomes solid, and infested with *Poa annua;* and when it happens to be near the acid vapours of some public works, it requires to be resown every spring.

When the two-shift, which consists of two plots or divisions of one and two years' grass, is adopted, the second year's plot is renewed in August. The land is pulverised with the grubber, and the roots and weeds brought to the surface, gathered into heaps and burned, and the ashes spread over it; or these are carted off, and dung or other ameliorating matter, should the condition of the land require it, laid on. The land is then ploughed and the seed sown. If the plants look delicate before winter sets in, liquid manure may be applied with the hose. Where there are no appliances of this kind, Peruvian guano, or other suitable portable manure, may be sown over it with the hand. The plants should be vigorous, but not too rank.

When the three-years' shift is adopted, the seed may be sown after the green crop either in August or early in March, and it will yield, according to soil and climate, weather and treatment, two, three, or four cuttings in the first year.

When the four-course shift is adopted, the seed is sown in spring along with the grain crop in the usual way; and if it is barley or bere, the grass will sometimes yield a cutting in a few weeks after the grain crop is removed.

The most suitable of these three modes of culture for any particular farm will depend on circumstances. Where the available land is limited, the two-shift will yield the most grass; on the other hand, where there is extent, and where corn crops are an object, the four-shift may be more answerable. The expense of seed and application of the liquid will, however, bear a higher proportion, if this be not counterbalanced by the beneficial effects of the liquid-manuring over a greater number of crops.

But, all things being equal, the three-shift of one and two years'

grass and a green crop, or alternate grass and green crop, is the preferable mode of cultivating Italian ryegrass, as after the liquid-manured grass the land is in prime condition for a green crop, and a green crop is the best preparation for the grass. Perhaps the best method of managing the green-crop plot in this shift is to have the one-half of it in early potatoes or early cabbages, after which the grass seed may be sown in the end of July or beginning of August; and if so, it will frequently yield a cutting in the same season: the other half of the green-crop plot may be in turnip, mangel, or late cabbages, when the grass-seed can be sown in March as above mentioned, thus giving more chances to the grass, and favouring its coming forward at early and different stages. It is, besides, good management to cultivate cabbages along with Italian ryegrass, as the two together supply a better food, especially for dairy cows.

The land does not tire or turn sick of Italian ryegrass. It has been grown consecutively on the same land for twenty years in this country, and has kept gradually improving instead of falling off.*

Italian ryegrass, likewise, succeeds very well after beans, either with the crop drilled on the flat sown after last grubbing and drill-harrowing, or after the crop is removed. In an early harvest it also succeeds to sow it after a grain crop has been removed, the land being previously well prepared and manured.

Collecting and Conveying the Liquid.—The basis of the economical cultivation of Italian ryegrass being the utilising of waste liquids, the mode of collecting and conveying these requires to be noticed. Tanks are put down in the most suitable places, into which the liquids from all sources are led by pipes of iron or clay. To prevent loss by infiltration and evaporation of the urine, the grips or floors of stables † should be made impervious, or there should be some other contrivances for collecting and conveying it, without loss, to the tank.‡ Where there is not a constant supply of water, there should be a pond for collecting and storing this necessary element. If there are no other sources, rain-water may be collected from the roofs of houses and other gathering ground. The liquid is most eco-

* This is an interesting fact. In other cases, however, we have heard parties, who have had considerable experience in the growing of Italian ryegrass, maintain the contrary view.—ED.

† The reporter has seen a vast improvement in the sanitary condition of stables, and a great saving of litter effected, by means of a channel placed in the centre of the grip and stalls, made of cast-iron in form of letter V, with perforated movable cover, which permits the urine to run off the moment it is voided.

‡ We have often thought that a great deal of needless expense is incurred in the management of liquid-manure. Conduits and tanks are generally puddled with clay to prevent filtration. It ought to be borne in mind, however, that urine undiluted by water has little power to permeate either sand or gravel, far less clay or ordinary earth. The urine forms a crust for itself on the surface, which seems to resist its descent completely, without any further means being used to effect the end than by keeping the rain-water out.—ED.

nomically conveyed and applied to the land by means of gravitation or the force-pump, and underground pipes, hose, and jet—appliances which give to the husbandman a new and important arm; and although inferior to these, many farmers contrive with the liquid-manure cart to grow a large quantity of grass. The cart and waggon combined is preferable for this purpose, as the liquid is taken out and the grass brought in with one *rake* of the horse, which saves time, and tear and wear, and does less injury to the land. The improved liquid-manure distributer of the small crofter consists of a large tin flask, with hose attached to the bottom, which is carried on his back, by means of hooks over the shoulders.

In the application of the liquid, however, an obstacle is found to the economical cultivation of Italian ryegrass as green forage. Although highly appreciating its advantages, many farmers consider that the necessary works and machinery for collecting and applying the liquid belong to a class of improvements which tenant-farmers cannot, solely at their own expense, prudently make. In times so auspicious for agricultural improvement, this difficulty may easily be got over, where, prompted by a sense of duty and interest, the landlord and tenant agree to the intervention of a Lands Improvement Company. It is nevertheless highly desirable that these works should be brought more within the reach of tenant-farmers by means of lessening the cost, such as building tanks on a cheaper method, the construction of pipes for conveying the liquid of cheaper material than iron,* and the invention of cheap and simple machinery for pumping it by animal power. However valuable steam may be for continuous working, or where much power is required, it is clear it cannot, on the majority of farms, be economically employed for this purpose. Italian ryegrass requires to be watered on the same day, or the day after, it is cut. The extent, therefore, being small, the time occupied in each watering would, on the average of farms, scarcely exceed fifteen or thirty minutes; so that to yoke in one or more horses for that time would be a cheap and simple matter compared with the getting up of steam.

At the same time, these works, especially if the two or three shift is adopted, might be executed on a scale which could not be considered as beyond ordinary tenant enterprise. Tanks could be made in a temporary manner, and there are few farms on which as much liquid could not be collected as would warrant the use of the liquid-manure cart, and great facilities are afforded where the liquid can be applied by gravitation. Even where the force-pump was re-

* Among recent scientific improvements, there is noticed bitumenised paper pipes for conveying water. Two of these pipes, of 5-inch bore and half an inch thick, sustained under hydraulic pressure, without bursting or breaking, a pressure of 220 lb. to the square inch, or equivalent to 506 feet head-pressure. The cost is understood to be one-half the cost of iron. The ingenious idea of hardening paper by means of bitumen under the influence of hydraulic pressure, so as to convert it into a substitute for iron, is due, it appears, to M. Jaloureau of Paris.

quired, a single horse, if the land was near to the tank, would give power for propelling the liquid over a considerable extent; and there is no improvement which the farmer can make which would yield so large and speedy a return of profit. Instances are known to the reporter where the cost of such works, through the advantage to stock of a seasonable and abundant supply of grass, has been defrayed the very first year. A farmer who has grown Italian ryegrass by means of these appliances for many years, writing the other day, says, "We feel now as if we could not do without it."*

Management and Application of Liquid.—When consisting of cattle urine, which forms the principal part of the available liquid refuse, it should be diluted with twice its bulk of water, which reduces it to the proper strength for ordinary conditions of the soil in regard to moisture. The water likewise absorbs and retains the ammonia evolved by the decomposition of the urine (chemical fixers act injuriously on the liquid for Italian ryegrass). In the colder seasons, however, and when the land is full of moisture, it will be more stimulating, and may then be applied a little stronger. On the other hand, when the weather is very hot and dry, and where there are a command of water and facilities for applying the liquid, it should be largely diluted. The principle, in short, is to add more water as the weather is hot and dry, and less as it is cold and wet.

The quantity must be regulated by the conditions of the soil and other circumstances. As a rule, the grass should not be stimulated beyond the capacity of bearing seed, as the juices will not be properly elaborated, and will have a laxative tendency on the stock.

The liquid should be applied immediately, or within a day or two after cutting, and then, as Mr Mechi has so poetically expressed the practical truth, "Spring-time begins again."

When the supply of liquid becomes short, as not unfrequently happens in the end of summer, diluted Peruvian guano, nitrate of soda, muriate of ammonia, or other nitrogenous or ammoniacal matter, may be substituted; or these substances may be put on in the dry state, and then water applied to dissolve and wash them into the soil, and also to supply the necessary moisture. Distillers' wash, gas-water, or the new manure liquid ammonia, will likewise be very suitable; and this is perhaps the best use to which the latter can be applied.

In applying the liquid to the new-sown grass, which should be early, great caution must be used; for if allowed to fall violently, much injury will be done both to the texture of the soil and the

* The number of sound and thoroughly practical hints here thrown out for effecting the distribution of liquid-manure are particularly interesting. The powerful effects of liquid-manure are acknowledged by all; but the question is not yet satisfactorily decided whether it can be more economically distributed by the barrel or by the force-pump and hose. Some of the suggestions thrown out will, we have no doubt, be appreciated by those who have a large supply of liquid-manure to distribute.—Ed.

tender young plants. There is here room for the invention of something that will break the force of the liquid, and let it come gently in contact with the soil. Perhaps a large coarse cloth spread on the ground, and shifted as the watering proceeds, or a frame of wickerwork on low wheels, which could be moved along, would be useful in facilitating this operation.

In winter the liquid may be applied to some part of the land as it accumulates. To the Italian ryegrass, it is quite possible to apply the liquid too largely and too strong, yet in proportion to its absorption by the soil will the soil be deepened and enriched, and, if not overdone, will yield the earliest and heaviest cuttings.

Early in the morning, when the earth and air are cool, and vegetation least liable to receive a check, is allowed to be the best time for applying the liquid. At that time any offensive odour given off during the operation is likewise least annoying. And although the utilising of liquid refuse be the basis of its economical cultivation, Italian ryegrass can be successfully grown on deep moist soils by dressing with soot, Peruvian guano, nitrate of soda, muriate of ammonia, &c., in the dry state. In this way the reporter obtained four cuttings in one leaky season, and a friend of his grew on a moss soil two seed crops in a season, for four or five years running, without resowing or artificial watering.

Mixture of other Grasses.—A mixture of other grasses and clovers may be an advantage on poor soils when intended for hay, but when designed for green forage, under the application of fertilising liquids, a mixture of any other variety of ryegrass is no advantage, as the Italian so quickly overtops them all that they only prevent it from tillering, and diminish rather than increase the produce.

As a supplement to the Italian, where it is liable to become thin on the ground in the second year, the reporter has tried all the grasses, and found cocksfoot (*Dactylis glomerata*) and meadow foxtail (*Alopecurus pratensis*) the most suitable. When supplied with moisture, or liquid-manured, these grasses yield frequent cuttings in the second year; and being of backward growth the first season, they interfere little with the Italian. As, however, their strong perennial roots may be difficult to eradicate, perhaps the better plan of keeping up the stock of plants is to sow a little of the Italian grass-seed the first year, early in August, immediately after the cutting of the grass. This precaution might be regularly followed; a little seed for the purpose could be ripened in a corner.

The thin appearance which Italian ryegrass sometimes presents, may arise from the habit which it in a singular degree possesses of accommodating itself to the supply of available food in the soil. Owing to its rapid growth, it cannot afford, like slow-growing plants, to wait on a supply, and when that is deficient, will run through its stages with a single seed-stalk, or what it can support in the

period of its growth; but on being dressed with a good supply of liquid manure, it will quickly strike out a number of vigorous shoots, and become a close luxuriant crop, illustrating its admirable adaptation as a worker-up of refuse fertilising liquids.

A plant of Italian ryegrass, with only one stalk, was in July last transplanted from a pasture-field, where it had grown for seven years, into newly-tilled ground, and watered with diluted liquid from the byre, and at this date (31st October) it is sending up 43 shoots; and a plant of it was observed this year, in a crop of the same, bearing 36 seed stalks, which shows considerable tillering powers.

Cutting.—Care should be taken to have the edge of the scythe, as it is technically termed, well set off the grass, as, when cut too near the root, much of it will not grow again. It is to this cause, in a great measure, that its thin planting on the ground, sometimes complained of in the second year, is to be attributed. Under this head it may be mentioned that, when growing fast, the proper stage of growth for different kinds of stock is about 12 days for pigs, 17 to 20 days for milk cows, and from 25 to 30 for horses. Mr Dickenson, to whom the public are under obligations in regard to this plant, recommends giving it to pigs, lambs, and sheep, when it has grown to 12 inches high; cows in milk, to 18 inches; horses in work, to 3 feet. When the supply of Italian ryegrass in the green state exceeds the demand, it is of course made into hay; and when intended for hay, it should be cut a little green.

Treatment in Winter.—Italian ryegrass has seldom been destroyed by frost, but it runs the risk of being rotted out by over luxuriance in an open winter. In that case it should be cropped by lambs or calves when the weather is dry, but not eaten bare, and when cut with the scythe late in the season, a dressing of rough stable-dung well spread on, to be again raked off in spring, affords it good protection against the effects of frost.

Concluding Remarks.—In conclusion, it only remains to be further observed, that when the plant under consideration readily yields two seed-crops in one year, neither inferior quality nor high price of the seed ought to militate against its universal cultivation, owing to its superior dietetic qualities and great productiveness economising land by the large amount of matter it works up on a small surface. Italian ryegrass has a high claim on the attention of all interested in the progress of agriculture. In estimating its advantages, it should never be forgotten that it may be grown from what would otherwise go to waste, while through its judicious cultivation, in addition to profit on stock, a large supply of manure may be obtained for the growth of other crops.

ON A NEW METHOD OF PLANTING HEDGES.

By ANDREW TAIT, Bankhouse, Penicuik,
Land Steward to the Right Hon. Sir George Clerk of Penicuik, Bart.

[Premium—The Silver Medal.]

AMONG the many improvements recently adopted in the art of agriculture, thorough-draining stands pre-eminent. Whether considered as a means of multiplying the food of man or animals, extirpating noxious weeds, or improving the quality of grasses, its value is incalculable. In addition to results so favourable, a considerable saving of seed is secured, a greater regularity in the germination, growth, and ripening of produce; and, what is of great importance, stock is allowed to depasture readily upon land which formerly was obnoxious by its moist and spongy character. But the benefits arising from this process, when combined with subsoil-trenching, are rendered both more numerous and efficacious. From recent experiments it has been found that, by this combination, a greater mass of the soil is pulverised, and a freer aeration is allowed to take place, which is necessary to supply the plant with food indispensable to its full nourishment and growth. It may also be observed, that such operations modify the climate and temperature of the soil, and thereby better maintain the healthy condition of the plant.

Upon the advantages thus accruing from drainage to vegetation in general, it occurred to the writer of this paper that with equal success the same principles might be adopted in the rearing of hedges. He accordingly tried the experiment in a field, the soil of which is of a tilly nature. Its altitude is 700 feet above the level of the sea, with a north-westerly exposure, and void of shelter. This he did by causing a drain to be dug 4 feet deep, using 1½-inch pipes and collars, and the margins to be trenched 2 feet in width on each side, and to the depth of about 20 inches. A bed for the thorn-plants was then taken out, and they were planted, 4 inches apart, immediately above, and in a direct line with, the pipes. The field had been previously thorough-drained to the depth of 4 feet, and the drains were distant 9 yards from each other. The hedge-drain was placed half-way between the field-drains; and in order to test the efficacy of the plan, one-half of the line of fence was trenched 5 feet wide, without a drain; and there being an inequality of the surface, it was supplemented with soil from another part of the field.

In comparing the two hedges, we shall suppose No. 1 to represent the portion having the drain below the plants, and No. 2 the other method.

The hedges were both planted on the 12th April 1858, and were cut over at the height of from 5 to 6 inches in November following; and at the present date (22d October 1859) the greatest length of the young shoots of No. 1 is 3 feet 10½ inches, with a thickness of three-eighths of an inch; while that of No. 2 is 3 feet 7 inches, with a thickness of five-sixteenths of an inch. The medium length of nine measured shoots of No. 1 is 3 feet 6¾ inches; and of No. 2, 3 feet 1¼ inch. Upon examination of the roots, it was found that No. 1 sent these downwards to a depth of 24 inches, while the fibres of No. 2 inclined to run more horizontally, their greatest depth being 17 inches. Immediately above the drain the soil was quite moist, while that of No. 2 was dry. The thorns of No. 1 sent out shoots from the surface of the ground to *the top*, where the plants were cut, and No. 2 had the whole of the shoots springing from near the *top* of the *old* stem. The under-shoots of No. 1 tend to grow horizontally, while those of No. 2 take a slanting direction, leaving the old stem quite exposed.

The cost, compared with that of a hedge planted on the edge of a ditch, will be found in favour of the new plan, when the first cost and keeping up of the ditch are taken into account, besides the saving of ground occupied by it. It may be observed that this drain will stand for one of the common drains of a field, and should not, therefore, be charged to the hedge; but we will assume that the fields on each side of the proposed fence have been already drained, and that the drain dug for the hedge is unnecessary for the proper drainage of the field, in which case the whole expense would then fall on the fence. The cost per rod of a hedge planted in this manner, reckoning pipe and collar to cost, including carriage, 30s. per thousand, and two-year bedded thorns 12s. per thousand, viz. :—

Cutting and filling drain and laying pipes, . .	£0	0	10
14 pipes and collars, at 30s. per thousand, . .	0	0	5
Trenching 20 inches deep, 5 feet wide, .	0	0	4
50 thorn-plants, at 12s. per thousand, . . .	0	0	7
Planting do., ...	0	0	2½
	£0	2	4½

Or not including cost of drain, 1s. 1½d.; while the old method of hedge and ditch will cost the following, viz. :—

Cutting ditch, ...	£0	1	8
50 thorn-plants, at 12s. per thousand, . . .	0	0	7
Planting do., ...	0	0	2½
	£0	2	5½

In summing up the advantages of this method, it may be reasonably expected that the plant will have a more equal supply of moisture. Even in a dry season, the air passing up the pipe, and

acting with that of the atmosphere above, will cause moisture to circulate through the soil by capillary attraction. The roots, by the trenching, have an increased space to seek for nourishment. Moreover, a saving, as has been already stated, is obtained in the drainage of the field, and less ground occupied than by the old method of hedge and ditch. From the equalisation of temperature thus produced in the soil, the plant will be more vigorous in spring, and better enabled to send forth strong and healthy shoots.

The appearance of the two hedges on the 26th October 1860 still shows a decided superiority in favour of No. 1. The strength of its stems, the number and length of the young shoots proceeding from these in lateral, sloping, and vertical directions, together with the density of the lower part of the hedge No. 1, furnish the most convincing proof of its more rapid growth, when contrasted with that part of the hedge designated No. 2. A few measurements just taken on the spot will serve to support the above assertions, although the apparent smallness of difference of these in detail does not serve to convey a just idea of the more striking difference which exists in the general aspects of the two parts of the hedgerow; and this may be accounted for by the greater number of unmeasured shoots laterally and verticallv, which, not being represented on paper, yet sufficiently indicate the superiority of Section No. 1. Taking a number of the strongest stems in each part of the hedge, the average thickness of these in No. 1 was nine-sixteenths of an inch, while that of those in No. 2 was eight-sixteenths. Again, taking several top-shoots in each, the average length of those in No. 1 was 3 feet, while that of those in No. 2 was 2 ft. 8¼ inches. The average length of the longest side-shoots in No. 1 was about 2 feet, while those in No. 2 averaged 1 foot 7 inches.

Before trying the above experiment, I was under the conviction that the thorn, being a surface-rooted plant, and requiring only a certain amount of moisture for its healthy growth, would in all probability send its roots no further than where they received the requisite supply, and thus leave the drain uninjured. I have only to add that this opinion is borne out by a great many extensive and skilful drainers with whom I have conversed on the subject, and who have informed me that they have never found the roots of the thorn penetrating the tile crossing underneath a thorn hedge.

The above experiment adds another proof to the advantages derived from thorough-drainage combined with subsoil-trenching.*

* This new method of preparing a bed for planting thorn hedges is well worthy of a trial. The future progress of the plants in this experiment should be noted and recorded. It is quite within the range of probability, however, that the roots of the plants may descend to the pipes, and fill them up by an abnormal growth stimulated by the air and moisture in the pipes. The natural habitat of the thorn

PROCEEDINGS IN THE LABORATORY.

By Professor Anderson, M.D., Chemist to the Society.

I.—ON THE COMPOSITION OF A CHINESE FEEDING CAKE, AND THE SEED FROM WHICH IT IS OBTAINED.

In the Transactions of the Society for January last I published a series of analyses of standard oil-cakes of different kinds, and from time to time have placed on record the composition of the rarer and more curious varieties as they have passed under my hands. I have now to add to these the results of the examination of a kind imported from China, which is interesting, not merely as showing that British agriculture draws its supplies from the most distant countries, but also because it is derived from a seed entirely different in its botanical relations from any of the ordinary oil-seeds.

The cakes are about four inches thick, somewhat irregular and clumsy, consisting of large fragments of the seeds, and appearing ill pressed—an appearance, however, which is not borne out by their composition. When a piece is beaten up with water, it does not form a stiff paste like cakes made from the ordinary mucilaginous oil-seeds. Its taste is not unpleasant, and resembles that of the pea or bean, though coarser and slightly rancid. The latter flavour, however, may be fairly attributed to the fact that the cake was not in good condition when imported, part of it being mouldy, apparently from its having heated during the voyage. The seeds from which it was made tasted exactly like peas. The composition was as follows:—

Water,	14.44
Oil,	6.88
Albuminous compounds,	45.87
Starch, sugar, gum, &c.,	21 48
Fibre,	5.25
Ash,	6.08
	100.00
Nitrogen,	7.34

The ash contained—

Phosphates of lime and magnesia,	1.32
Phosphoric acid, combined with the alkalies,	1.06
Sand,	0.49

In point of nutritive value, this cake must be considered as tak-

is on the dry banks of our highland or lowland valleys; there it sends its roots far down into the subsoil. Into tilly subsoils they do not penetrate, but run along the surface. It thrives on damp or wet soil if the water is not stagnant, and it even seems to luxuriate in such circumstances. The roots in this case run along the surface. Hence the roots of thorn may affect the aerated water in the drains, as is the case with many other trees, which often choke up large pipes containing running water.—Ed.

ing the first place among cattle foods. It bears a close general resemblance in composition to decorticated earth nut-cake, but surpasses it in the quantity of albuminous or proteine compounds, to the extent of nearly 2 per cent. The oil, however, is less by about the same quantity, and the proportion, which is as low as that found in the best pressed home-made cakes, proves that the seeds must have been subjected to very powerful pressure, and that the Chinese, with their rude presses, have obtained a result as good as can be got from the best constructed machinery of this country. The small proportion of fibre, and the ash, rich in phosphoric acid, all indicate the high quality of this cake, which is especially fitted for use with those kinds of food which are deficient in albuminous compounds.

A small packet of the seeds from which this cake was made accompanied the sample. They are about the size of large peas, slightly oval, with a rather shining external coating, which is paler and more purely yellow in colour than the common pea. They resemble it also in taste. I submitted them to Professor Walker Arnott, who is intimately acquainted with the botany of India and other Asiatic countries, and he was of opinion that, as far as their general characters are concerned, they appear to belong either to the genus *Phaseolus* (of which the kidney-bean is a species), or to *Cajanus*, various species of which are largely cultivated in Eastern countries for their seeds, and are used for feeding horses. On afterwards communicating to him the analysis given below, he considered the results to disprove this view entirely—no seeds of these plants being known in which oil occurs to any extent—and suggested that they might belong to the genus *Corcoras*, from a species of which New Zealand flax is obtained, and of which the seeds are oily, or to some allied genus; but he would not venture to give a definite opinion, as the characters of many of these seeds are so similar that it is impossible to distinguish them. I have sent some of the seeds to the Botanic Gardens, and should they grow, we shall be able at a future period to decide this point. Their composition is:—

Water, . .	10 55
Oil, . . .	20.28
Albuminous compounds,	38.60
Starch, sugar, gum, &c.,	18.72
Fibre, . .	5.11
Ash, . . .	6.74
	100.00
Nitrogen, ...	6.09

It is at once obvious that, if we deduct from this two-thirds of the oil it contains, there must remain a cake of almost exactly the composition already given. On contrasting this with the analysis of an average sample of peas which may be taken as a representa-

tive of the natural family, including the kidney bean, &c., the difference is manifest:—

Water,	13.51
Oil,	2.13
Albuminous compounds,	24.31
Sugar, starch, gum, &c,	47.64
Fibre,	9.85
Ash,	2 56
	100 00
Nitrogen,	3.89

There is not the slightest resemblance between this and the Chinese seeds; and there can be no doubt that the latter belong to some entirely different plant, of a kind not hitherto known as a feeding substance. Though very improbable, it is just possible that some of the tropical leguminous plants may contain more oil and albuminous compounds than those which inhabit the temperate zones; but on this point there is at present no information, and I have looked in vain for analyses of any such seeds growing in warm climates.

The cake now described has been tried for feeding cattle, and I am given to understand that the results have been very satisfactory. It appears, also, that it can be imported into this country with profit when freights are low. It is doubtful, however, whether it could be made an article of regular import; but in such seasons as the last, when the crops are deficient and artificial foods high in price, it may prove a valuable and useful addition to the list of substances on which the farmer may fall back.

II.—ON A MARL OF UNUSUAL COMPOSITION.

Marl is a name applied to a white highly-divided substance usually found deposited in hollow places in valleys and the bottom of stagnant waters, where it is produced partly by the mechanical action of water carrying with it the clay and carbonate of lime from higher districts, and partly from the deposition of a quantity of the latter substance which has been held in solution in the water. Hence the composition of marls is extremely variable; in limestone and chalk districts they consist almost entirely of carbonate of lime, while in others this substance is largely intermixed with clay. Deposits of marl have been found which do not contain more than 10 or 12 per cent of carbonate of lime; but I have seen no analysis of samples like the one now in question, which contains so small a quantity of that substance that it may be said to be practically absent. This marl occurs in Glenkindie, in Aberdeenshire. It has all the external characters of an ordinary marl, is nearly quite white, and very soft and pulverulent in appearance.

Its composition is—

Water, with a little organic matter,	13.40
Alumina,	19.67
Peroxide of iron,	3.81
Lime,	0.62
Magnesia,	0.38
Alkalies,	traces.
Chlorine,	0.52
Soluble silica,	0.75
Insoluble siliceous matters,	60.63
	99.78

This substance is therefore essentially a clay. It contains nearly 20 per cent of alumina, and of the large quantity of water found in the analysis the greater part, 8.3 per cent, is in combination with the other constituents as in ordinary clays, and is only expelled at a red heat. It has been generally supposed that the value of marls is to be attributed to the carbonate of lime they contain, and, if that be the case, this substance would have little manurial value; but when we come to inquire minutely into the question, we shall see good reason to doubt whether this is always the case. It is by no means found that the value of a marl depends on the proportion of that substance it contains. On the contrary, there are many kinds containing but a small quantity of lime and abundance of clay, and usually called clay marls, which give as good or even better results on the field than the highly calcareous marls. The truth is, that in both cases the action is less a chemical than a mechanical one, and the effect is greatly dependent on the nature of the soil to which it is applied. In the case of this substance, we may expect its effect to be most marked on light and sandy soils, to which it will give additional stiffness, and supply a quantity of highly divided clay, in the most favourable condition for absorbing and retaining ammonia. In fact, it would modify the general composition of the soil, and make it more capable of absorbing and preserving without loss all the valuable constituents of the manure. But without the subsequent use of abundance of farmyard manure, it would have comparatively little beneficial effect.

The general subject of the use of marl and all similar substances is one to which comparatively little attention has of late years been paid, and most of the observations and experiments made with it are of old date and not very minute or precise. Indeed, the tendency at the present moment is to rely chiefly upon manures, and more especially manufactured manures, for the amelioration of the soil. Without at all disputing the importance and indispensability of these substances, it may be questioned whether we do not too much undervalue substances which, like marls of this kind, are mainly mechanical agents, and whether there are not many cases in which the liberal application of materials which have no

value except the cost of cartage, may not often in the long-run effect a more permanent improvement of the soil, and enable it to be retained at a certain level of productiveness, with a smaller expenditure of the more costly manures. This, however, is a matter which, taken in its widest aspect, opens up the whole question of the mechanical improvement of the soil, which it would be out of place to discuss in detail here. There can be no doubt, however, that wherever highly divided substances like this marl are to be found, they should be taken advantage of, their composition being made the guide to the kind of soil to which they ought to be applied.

[NOTE.—The marls of Scotland would furnish a most interesting subject for investigation. The marls existing in the beds of former lakes, whose waters flowed from the greenstone or trap soils, are usually exceedingly rich in carbonate of lime. Such marl beds are common in the counties of Perth, Fife, and Forfar. The nature of their effects on many soils must still be reckoned among the unresolved problems of agriculture. The late Professor Johnston considered that the effects were chiefly mechanical. That the soil is mechanically changed is at once apparent to the eye. It is difficult, however, to understand how the mere rendering of the soil loose should totally unfit it for growing certain plants. When applied in quantities to the stronger soils of the trap, it has a most beneficial action; but when applied to the weaker soils of the Old Red Sandstone, or more especially those of the Northern Drift, its effects are remarkable: wheat and oats die before coming into ear; barley grows of a palish green colour, and the straw is soft; while rye is improved in every way. On the other hand, turnips grow free from finger-and-toe, but twitch and spurry disappear.—*Ed.*]

III.—ON THE COMPOSITION OF GAS MANURE.

For several years back a substance has been sold under this name, which is obtained by one of the patent processes for the purification of gas, and has been recommended as a cheap source of ammonia. It is a dirty greenish-looking damp powder, with a distinct smell of gas-tar. Its composition is somewhat variable; but it is chiefly remarkable for the large quantity of sulphur it contains, which is sometimes so large that it burns with a blue flame, and evolves abundance of sulphureous vapours. In a sample in which the quantity of sulphur was determined, the composition was found to be as follows:—

Water,	13.17
Organic matter,	28.75
Sulphur,	36.83
Iron,	6.03
Sulphate of lime,	9.24
Alkaline salts,	4.32
Sand,	1.66
	100.00
Ammonia,	4.60

The quantity of sulphur in this case was extremely large, and it was found to be present partly in combination with the iron, and partly in the form of a compound called the sulpho-cyanide of ammonium. The presence of the latter substance could be very easily detected by washing the manure with water, and adding a salt of iron to the solution, when the deep blood-red colour, which is the characteristic of that compound, is produced. I have not met with any sample containing so large a quantity of sulphur as this, although it is always present to a greater or less extent; but the number of cases in which it has been directly determined is not large, because it is of little importance in a manurial point of view. I believe the process by which this substance is obtained is by mixing together sulphate of iron with lime or chalk, and a small quantity of sawdust, to render it more porous. With this mixture the purifiers at the gas-works are filled, and the gas, in passing through, leaves behind the ammonia and sulphur it contains. When the mixture ceases to absorb it is removed and exposed for some time to the air, when it regains that property and can be used again; and this is repeated until it contains, in some cases, a very considerable quantity of ammonia. I have examined samples containing as much as six and even seven per cent of that substance, or, more correctly speaking, of nitrogen corresponding to it; for part of that element, though stated as ammonia, for convenience in calculating the manurial value, is actually found in the form of cyanogen. The greater part of this manure has hitherto been used by the manufacturers of superphosphates, who use it as a means of obtaining ammonia, when bone-ash and mineral phosphates are employed. I am not aware of any cases in which it has been employed alone; but experiments with it would have a very special interest dependent on the presence of sulpho-cyanogen. That substance is a constituent of mustard, and many other plants of the same family to which the turnip, rape, cabbage, &c., belong. The peculiar volatile oil, to which the acridity of mustard is due, and a similar compound which is the cause of the characteristic smell of the turnip, are compounds of a very remarkable kind, and contain sulpho-cyanogen. It would be very interesting to ascertain whether the use of a manure containing this substance has any effect in increasing the quantity of volatile oil contained in the turnip or not. It can scarcely be expected that the form of combination in which the nitrogen exists in a manure (provided, of course, it be not absolutely available to the plant) can have any very marked effect on the produce, but it *may* affect the quantity of volatile oil. Should it do so, however, it would be by no means an advantage, but rather the reverse, because it would increase the peculiar turnipy taste and smell which it communicates to the milk and butter of cows fed on that root.

ABSTRACT of the ACCOUNTS of the HIGHLAND

(The detailed Accounts will be submitted, in terms

CHARGE.

1. Balance in the Royal Bank of Scotland at 30th Nov. 1859,			£1412 10 1
2. Medals on hand at do.			31 18 6
3. Arrears of Subscriptions at do., . .		£290 15 0	
Less written off as irrecoverable, .	£79 9 0		
Extinguished by Life Compositions,	32 19 0		
		112 8 0	
			178 7 0
4. Interest on £9500 Heritable Security, . .		£321 7 0	
5. Dividends on £21,026, 0s. 5d. Bank Stock, .		812 19 8	
6. Dividends on £6570 Debentures, . .		270 14 9	
7. Dividend from British Fishery Society, .		20 0 0	
8. Progressive Interest on Bank Account, .		23 8 11	
			1448 10 4
9. Annual Subscriptions, ...			887 7 0
10. Life Subscriptions, ...			933 11 6
11. Subscriptions in aid of Local Competitions, . . .			66 0 0
12. CHEMICAL DEPARTMENT—			
1. Balance in Royal Bank at 30th Nov. 1859,		£49 16 2	
2. Annual Subscriptions, ...		152 17 6	
3. Progressive Interest on Bank Account, .		0 8 0	
			203 1 8
13. EDINBURGH SHOW, 1859—Receipts per Abstract, . .			3751 0 6
14. ABERDEEN SHOW, 1858—outstanding Entry Money, . .			4 0 6
			£8916 7 1

and Agricultural Society, for the Year 1859-60.
of the Charter, to the General Meeting on 16th January 1861.)

Discharge.

1. Establishment Expenses—							
1. Secretary's Salary,	£500	0	0				
2. Allowance for Heating, Cleaning, Service, &c.,	83	5	0				
3. Auditor's Fee,	30	0	0				
4. Salary to Editor of Transactions for 9 months,	31	10	0				
5. Clerks' Salaries,	167	6	0				
6. Allowance to Curator of Machinery,	10	0	0				
7. Feu-duty, Taxes, Repairs, &c., Albyn Place,	131	1	5				
					£953	2	5
2. Chemical Department—							
1. Chemist's Salary,	£300	0	0				
2. Balance in Royal Bank, 30th Nov. 1860,	3	1	8				
					303	1	8
3. Veterinary Department—							
1. Allowance to Professor Dick,	£26	5	0				
2. Medals to Students,	5	12	0				
3. Advertising,	5	14	0				
					37	11	0
4. Museum—							
1. Feu-duty, Taxes, Repairs, &c.,	£101	11	10				
2. Heating, Cleaning, &c.,	7	0	8				
3. Porter's Wages and Livery,	36	7	0				
					144	19	6
5. Premiums—							
1. Premiums for years prior to 1859,	£77	10	0				
2. Premiums for Reports 1859,	76	14	0				
3. Premiums for Edinburgh Show, 1859,	1433	6	6				
4. Premiums for Local Competitions, 1859,	600	6	0				
					2187	16	6
6. Printing,					169	16	10
7. Stationery,					22	0	0
8. Advertising,					22	1	6
9. Postages and Carriages—							
1. Ordinary Postages and Carriages,	£62	15	7				
2. Postage of Charters and Bye-laws to Members,	15	15	4				
3. Postage of Circulars and Schedules for old trees,	5	7	6				
					83	18	5
10. Miscellaneous Expenditure—							
1. Reports of General Shows published in Transactions,	£22	12	0				
2. Cost of Investments; Recovering Arrears, &c.,	23	8	0				
3. Agricultural Education,	13	4	3				
4. Travelling Expenses,	7	1	6				
5. Meteorological Society Subscription,	5	0	0				
6. Reporting General Meetings,	3	19	6				
7. Bank Charges and Stamps,	3	12	10				
8. Incidental Expenses,	3	7	7				
					82	5	8
11. Edinburgh Show, 1859,—General Expences per Abstract,					2198	7	7
12. Amount carried to permanent fund, and invested,					442	17	8
13. Balance in Royal Bank at 30th Nov. 1860,					1895	19	4
14. Medals on hand at Do.,					50	13	0
15. Arrears of Subscription at Do.,					321	16	0
					£8916	7	1

Edinburgh, 19*th December* 1860.

ANTHONY MURRAY, *Convener of Finance Committee.*
HENRY STEPHENS, *Member of Finance Committee*
ARCHD. HORNE, *Auditor.*

EDINBURGH SHOW, 1859.

(The detailed Accounts will be submitted

RECEIPTS.

1. LOCAL SUBSCRIPTIONS—						
1. Contribution by City of Edinburgh,	£100	0	0			
2. Contribution by Proprietors in County of Edinburgh,	350	7	6			
3. Contribution by Proprietors in County of Haddington,	372	0	0			
4. Contribution by Proprietors in County of Linlithgow,	85	11	9			
5. Contribution by Proprietors in County of Peebles,*	0	0	0			
6. Contribution by Tenant Farmers in the four Counties,	26	4	6			
7. Contribution by United East Lothian Agricultural Society,	20	0	0			
				£954	3	9
2. AMOUNT COLLECTED IN SHOW-YARD—						
1. Drawn at Gates,	£1999	13	11			
2. Drawn at Trial of Implements,	63	9	10			
3. Farm-servants' Tickets,	28	7	0			
4. Catalogues and Awards sold,	252	3	0			
				2343	13	9
3. ENTRY-MONEY—						
1. On Stock,	£57	10	9			
2. On Implements,	64	17	6			
				122	8	3
4. Rent of Stalls in Show-Yard,				250	9	0
5. Rent of Refreshment Booth,				45	0	0
6. BANQUET—Society's Surplus on 230 Tickets at 1s.,				11	10	0
7. Interest from Royal Bank,				23	15	9
				£3751	0	6

* Not yet reported.

ABSTRACT OF ACCOUNTS.

to the General Meeting on 16th January 1861.)

PAYMENTS.

1. PREMIUMS drawn at 30th November 1860,				£1433	6	6
2. SHOW-YARD—						
1. Contractor for fitting up yard,	£1028	4	5			
2. Permanent Park Gate for Proprietor,	52	18	2			
3. Restoring surface for Proprietor,	20	13	8			
4. Proprietor's Agent and Engineer,	26	8	0			
5. Payment to Tenant of Field, per award,	92	10	0			
6. Payment to Tenant of Links, per award,	12	0	0			
7. Bedding for Stock,	53	11	0			
8. Refreshments for Judges and Committee,	42	8	0			
9. Colours, £4, 5s.; Militia Band, £10, 15s.,	15	0	0			
10. Omnibuses for Judges,	2	5	0			
11. Lithographed plans of Yard,	7	10	0			
				1353	8	3
3. POLICE FORCE,				24	0	0
4. TRAVELLING EXPENSES of Judges, Staff, Secretary, Clerks, &c.,				95	5	4
5. HOTEL BILLS and Tickets to Banquet for Judges,				127	4	0
6. BANQUET—Rent of Hall, Music, &c.,				23	18	9
7. PRINTING—						
1. Catalogues,	£106	11	9			
2. List of Awards,	20	18	6			
3. Bills and Placards,	27	18	6			
4. Premium Lists, Certificates, Circulars, &c.,	55	9	9			
				210	18	6
8. ADVERTISING—						
1. At Railway Stations,	£20	0	0			
2. In Newspapers,	35	11	6			
				55	11	6
9. TRIAL OF IMPLEMENTS—						
1. Use of Ground and Damage to Crop at Myreside,	£99	0	0			
2. Trench-Ploughing and preparing ground there,	7	9	0			
3. Labourers' wages and damage to wheat in thrashing, at Myreside,	20	0	0			
4. Damage to Crop, by trial of Reaping Machines at Liberton Mains,	22	16	0			
5. Refreshments to workmen at Liberton Mains,	3	0	0			
6. J. & P. Cameron for Cartage of Implements,	26	15	0			
7. Cabs to Trials for Judges,	5	15	0			
8. Chaplin & Co., for use of Steam Engine,	1	0	0			
9. Mangold Wurzel for Root-Cutters,	1	15	0			
				187	10	0
10. Postage Account,				26	11	5
11. Clerks,				30	4	6
12. Assistants, Porters, and Labourers,				36	10	5
13. Stationery and Miscellaneous Expenditure,				17	4	11
14. Local Collector's Commission on Linlithgow Contribution,				10	0	0
15. Balance,				119	6	5
				£3751	0	6

EDINBURGH, 19*th Dec.* 1860.

ARCHD. HORNE, *Auditor.*

State of the Funds of The Highland and Agricultural Society,

At 30th November 1860.

I. Investments—						
1. Heritable Bond, ...				£9,500	0	0
2. Bank Stocks, present value, ...				21,026	0	5
3. Railway Debentures, ...				4,570	0	0
4. Glasgow Water Corporation Debenture, . .				2,000	0	0
5. Ten Shares, or £500, of the British Fishery, . .				200	0	0
				£37,296	0	5
II. Heritable Property per Valuation, ...				£7,487	18	5
III. Fluctuating Balances—						
1. Balances in Royal Bank, . . .	£1,899	1	0			
2. Medals on hand, ...	50	13	0			
3. Arrears considered recoverable, . .	238	8	6			
				2,188	2	6
				£46,972	1	4

Abstract of the Accounts of the Argyll Naval Fund for 1860.

Charge.				Discharge.			
1. Balance in the Royal Bank of Scotland at 30th November 1859, . . .	£193	2	11	1. Allowance to one Recipient, ...	£40	0	0
2. Interest on £3000 Heritable Security, . .	101	9	7	2. Balance in Royal Bank at 30th November 1860,	324	8	9
3. Dividends on £1700 Debenture, ...	65	8	8				
4. Progressive Interest on Bank Account, . .	4	7	7				
	£364	8	9		£364	8	9

ON THE DRAINAGE OF SHEEP-FARMS.

By James Cowan, Glasgow.

[Premium—The Gold Medal.]

Throughout Scotland there is a great quantity of land still lying in a state of nature, which is capable of being brought under tillage and profitably improved. There is a still greater amount of land which, either from its steep and rugged character, its natural sterility, or unfavourable situation, must remain in the state of hill pasture. Nor would it be profitable in present circumstances to attempt its reclamation, as the breeding and rearing of sheep upon such lands is at present, and in all probability will continue to be, a profitable occupation, as the demand for feeding-stock is steadily on the increase. The more obvious improvements that circumstances admit of being applied to this land are shelter and draining. To the latter of these improvements I shall confine my remarks in the following report, taking a view of the *general principles* by which the drainage of hill pastures ought to be regulated, the most approved mode of laying out drains, the depth and width best adapted for different soils, the expense of draining a hill farm, and the returns that may be calculated upon.

The hill pastures of Scotland present an extremely diversified aspect, varying from the alpine ruggedness of the West Highlands and the bleak moors of Ayrshire, to the soft green hills of the English border and the meadow-looking pastures of Eskdale and Upper Teviotdale; while the soils of which the wet land is composed are equally varied, and are often lying in such positions, and thrown into such forms by the agencies that have combined to produce them, as to render general principles difficult of application; and special rules have often to be modified so as to suit particular circumstances.

A reference to the nature of the soil and the plants which it bears, must form one of the primary considerations in the practical application of any system of drainage; the form, distance, and size of drains having in all cases to be regulated by the nature of the soil to be laid dry, the character of the plants which it bears, the position in which it lies, and the connection that it may have with the drier grounds by which it is surrounded. Another matter of consideration ought to be, what kind of plants it may be requisite to retain in the soil; and what effect draining will have in retaining and improving certain varieties, and in deteriorating and wearing out others. The knowledge of this must be gained by marking the effects of draining upon land of similar soil and quality, and

some acquaintance with the nature of the plants that are indigenous to them.

Where the soil is entirely composed of a cold stiff clay, lying upon a slope or ridge, and producing only the coarser grasses and lighter bents, such as flying-bent (*Agrostis vulgaris*), and wire-bent (*Nardus stricta*), which, being yearly drifted off the land by the dry winds of spring, thus preventing the accumulation of a more active soil—close draining upon this land should never be resorted to, as a large proportion of soils of this character, when closely drained with open drains, instead of producing plants in greater abundance and of a finer quality than those formerly predominating, have by this means been rendered more harsh and unpalatable, while some of the more succulent plants which it formerly yielded, and which are in request during the dry months of spring when other food is scarce, often disappear from it altogether. But the case is widely different when land, composed of a subsoil of retentive clay, is lying upon a comparative level, from which the water does not readily flow off. Here the plants are generally of a very different character, being composed of strong rush (or *Juncus acutiflorus*), resembling a canebrake, into which the sheep seldom enter after it has attained to a certain height, except by tracks leading straight through to the drier ground on either side. Owing to this rank vegetation falling down annually and decaying upon the spot, there is a deep covering of vegetable remains overlying the subsoil of cold clay. This land requires, and improves by, close draining—the sprett diminishes, and in some situations, where the soil can be thoroughly dried, it disappears altogether, its place being occupied by a thick covering of fine grass, mixed with white clover (or *Trifolium repens*), and affording pasturage of the best description.

Bog land, composed of peat-moss or loose loam, is another kind of soil that may be closely drained with much advantage. But as the rush and sedge (or *Carex*), which are in much request in the dry months of spring, is more succulent and palatable upon this soil than upon any other, care must be taken not to over-dry it, and so make them decay and wear out of the soil, more especially in situations where the surrounding land is mostly dry. A considerable proportion of this land lies in basins, and has been formed by the decomposition of aquatic plants, and is often of great depth. In numerous instances, the form of what was once a swamp or lagoon is distinctly visible: an embankment of sand or boulder clay thrown across the valley or glen, had kept in the waters for some time, during which mud, sand, and other deposits, washed into it from the higher grounds, had formed a bottom, where reeds, sedges, and other aquatic plants had flourished and decayed. The water issuing from the lower end of the swamp appears to have gradually cut through the embankment, forming a

water-course, which, when it had wrought itself down to a certain level, would be laid comparatively dry; and the character of the plants appears to have changed from the flag and reed to that of the rush, and other plants common to the softer grounds. When properly dried, these again disappear, giving place to the clovers and softer grasses. This land possesses elements of great fertility; and, while in numerous instances the plants upon the clay soils have been deteriorated in quality, having become coarser and less feeding, those upon soils formed by a mixture of peat-moss and mud have maintained their place, and retained their feeding qualities unimpaired. It is quite obvious that the flat lands in the bottom of many of our pastoral vales, and even in not a few of our wider straths, have at one time been a chain of lakes. This appearance is stamped upon them in characters that cannot be mistaken; the natural embankments still remain, through which the burn or water has cut its way, leaving the two sides as if they had been riven asunder. The land formed in these basins is almost invariably good, and, where so situated as to be cultivated as arable land, yields crops of a superior description.

No description of hill land improves more by draining than loose mossy soils, where the surface is green; but the case is widely different when the soil is composed of solid peat-moss, and covered with the usual produce of that deposit, in the shape of heather, deer-hair (or *Scirpus cæspitosus*), draw-moss or cotton-grass (*Eriophorum vaginatum*), and stool-bent (*Agrostis stolonifera*). Some of these form the staple food of the hill-stocks during the barren months of spring, and upon which they thrive better than any other food at their command at that season; but in almost every instance these plants are deteriorated in quality when the moss is dried. Several of them have long and succulent roots, which the sheep readily draw out of the wet land; but when once it is laid dry, the roots not only get smaller and drier, but, owing to the moss getting firm from the draining, they cannot be pulled up; and as the best part of the plant is that which is below the surface, it is consequently lost. The draining of solid peat-moss is in very few cases attended with any advantage, except in some peculiar situations, where there may be stagnant water, or where there is a large quantity of surface-water flowing off, which it may be necessary to prevent from descending upon land of a different description.

There is another variety of wet land that I shall specify—that lying at the base, or on the lower slopes of steep hills, and which has been formed by the disintegration and wearing away of the rocks by the atmosphere, and washed down by the rains to the foot of the hills. It is generally along the line of this deposit that the water from the higher parts of the hill issues forth; for, wher-

ever there is a piece of table-land, or, more especially, where there is a flat tract of peat-moss acting as a reservoir, the water from this finds its way down through the crevices of the rocks, seldom appearing at the surface until it either reaches the foot of the hill or some superior flat, upon which the washings from the upper grounds have been arrested. The land formed by these deposits is for the most part good, and, when laid dry, sharp and early, and is soon thickly covered with white clover. In general it does not require close draining, and the drains only of a medium depth; and this is often all that is attainable, owing to obstructions arising from the quantity of stones mixed with the looser soil.

In laying down general principles for the drainage of a sheep-farm, a serious error might be committed if special reference was not had to both the extent and quality of the dry steep land that may be upon it. Where there is a large proportion of dry hard ground, whether covered with heather, or green lea-land overrun with moss and coarse grass, and upon which the growth is late in spring, the wet land should never be so thoroughly dried as upon farms where there is either a wider extent of deep and damp soil, or where the lea-land is good and sharp, the plants finer, and the growth comparatively early. The reasons for this will be sufficiently obvious, upon taking a direct look at the situation of such a farm during the spring months, or during a continued drought in summer. The heather is then out of season, and the bare lea-ground either not sprung up or withered by the drought. At these times, plants that are soft and succulent are in much request, and eagerly sought after by the sheep and to retain them in the soil upon a dry farm is of the utmost consequence. Now, when every moist spot is laid thoroughly dry, plants, such as the common rush and sedge, with others that draw up from the root, either disappear altogether, or else get hard and stunted from want of the necessary moisture, and the stock suffers from a want of that proportion of softer food which the dry nature of the hill pasture at particular seasons renders necessary for their general health. I have seen several farms much injured by over-draining, and among others one of great extent in Selkirkshire, upon which there is a large proportion of dry steep land of indifferent quality. Upon this farm every damp spot where a drain could be made was laid dry, every well-strand led into a channel, and the whole regularly cleared out and kept running. The consequence was, that in a short time the plants suited for spring and times of drought disappeared; the grass upon the clay land became harsher and more unpalatable; and the stock, notwithstanding all the skill and expense put forth for their improvement, grew smaller in bone, and more difficult to keep up in condition.

There is still another element which should enter into any general rules that may be laid down respecting hill-draining, and that is, the amount of rainfall in the district. For instance, it would neither be wise nor expedient to drain a hill farm situated among the Ochils (allowing even that it contained as much wet land) so thoroughly as one of the same character lying in the west of Argyllshire, or in one of the islands; nor yet to lay a farm as dry upon the lower reaches of the Tweed, the Ettrick, or the Yarrow, as one in the more damp districts of Ettrickhead or Eskdalemuir; for, while the latter is frequently deluged with heavy rains, the former has only moderate showers; and where the one may be benefited by a dry spring and warm summer, the other may be either withered by dry winds, or parched and burnt up by the rays of the sun and long-continued drought. Owing to the attraction of the clouds by the hills, frequent showers fall out in the higher and damper districts, which either never reach, or else pass lightly over, the lower and drier grounds. In a district where the amount of rainfall is small, and the soil in general easily affected by drought, there is always a greater demand at certain times for the softer plants, the produce of damp land, than there is in tracts where a heavy annual rainfall may with certainty be calculated upon and where land of every description is kept in a damp and softer state, and where more drains are required to carry off the water falling within a given compass. This principle is so plain, that it would be superfluous to insist upon it.

I have already stated that special rules must be often modified, so far as to suit the various forms that the wet land may present, and the different positions in which it may be found to lie. Still, in the laying out of drains, certain leading principles must be kept in view, and either carried out to their full extent where ample scope is afforded for their development, or only so far as circumstances will allow when applied to smaller patches often exhibiting a variety of aspects both in form and soil. There are two different systems of laying out drains at present in use, although one of them may be said to have been only tried as yet by way of experiment: these are, the old method of laying them across the land nearly at a right angle to the run of the water; and the newer method of straight-up-and-down-hill drains, parallel with the waterfall, and upon the same principle as applied to arable land. Drains laid on in this manner must be deep, in order to dry the land effectively, and, when made deep, must be covered, otherwise, running straight up and down hill, they are right in the line of the sheep tracks, and have consequently all to be crossed. Besides this, when the drains are of any length, the descent steep, and the soil in any degree friable, they are apt to be wrought so deep as to become positively dangerous at all times, more especially when stock is

low in condition, or to young lambs, and often destroy a considerable quantity of land by the sand and other deposits which they throw out. That deep tile-drains would be the more effectual and better mode of drying bog land, either of a mossy or loamy soil, there can be no doubt, more especially where it is lying flat, or nearly so, and where it is often difficult to get open drains to run, and likewise in situations where the drains must of necessity be short, and without sufficient water or declivity to clear themselves. Even where a sufficient run can be obtained upon bogs of a rich loam or mossy soil, new drains are apt to be filled up by the first winter's frost, which bursts out the soil upon the sides. This falls into the bottom as soon as the fresh comes; and I have often seen drains half filled up after the first frost, and having either to be cleaned out anew, or else lose the benefits they were intended to produce. There may be upon a high farm many acres of soft bog land, upon which deep and closed drains would work the most marked improvement; but it may be lying in such a situation as renders the conveyance of either stones or tiles to it an utter impossibility; while, at the same time, the wet land that lies convenient and accessible, may be of such a character, as their application might deteriorate instead of improve. Stiff clay land is often over-dried with open drains, and the grasses get coarser and wilder; but the case may be widely different with this kind of land when the subsoil is dried with deep drains, and the soil thereby rendered more open and porous, admitting the atmosphere, and allowing the rain-water to filter through it, so that even an improvement proportionably equal to that which is effected upon loam and moss soils might be exhibited. But for this I have no data, the application of the principle to hill land being but in its infancy, and few experiments having been made in order to test its efficacy upon the various soils of which the wet land is composed.

There is a description of land which I have not mentioned, and to which tile-drains might be applied with every chance of success, wherever it lies convenient for their adoption; that is, hard tilly soil, having a thin layer of earth or loose moss upon the surface. In different parts of the south of Scotland (particularly about the water of the Ale in Roxburghshire) there is a considerable extent of this land; and wherever it abounds, the stock are subject to rot; and open drains in numerous instances have failed in drying it, as, where laid across the slope of the land, and cut no deeper than through the few inches of soil upon the surface, there is not depth of soil to form a drain sufficient to intercept the flow of the water which runs along the top of the impervious subsoil. Where the pick has been used, and the drains laid on up and down hill, the land has been dried; but the depth required to render them effectual has been found too great to allow them to remain as open drains with-

out danger of losing stock. Wherever any small patch of land of the above description has been tried with covered tile-drains, the most marked improvement has followed. They have dried it thoroughly, and improved the sward, although, from the limited extent to which they have been applied, it is impossible to speak of the effects produced upon the health of the stock by diminishing the cases of rot. There are pieces of mossy soil resting upon clay, and lying either flat or upon a gentle slope, where the drains may be laid up and down hill with advantage, and left open without much risk of danger. Being short, the quantity of water which they collect cannot run them so deep as to render them dangerous; and although they may appear deep at first, yet, when cut through the moss down to the clay, the moss consolidates and contracts so much, that in a short time the drains are no deeper than upon other soils where they were cut much shallower at first, but where the soil does not contract so much upon being laid dry. I have seen small patches of wet land of the kind mentioned tried with drains 2 and 2½ feet deep, and filled from 12 to 18 inches with stones, and the turf laid on the top, and then filled with earth to the surface. They seemed to act well. There are large tracts of wet land, throughout hilly districts, lying at the foot of steep hills, where abundance of loose stones of all sizes may be had, and which could readily be applied to the purpose of filling drains. What I have observed of this mode of filling them upon hill pastures is too limited to draw just conclusions; and with regard to those that I have seen, there has not been time to test their durability. Still I have no doubt but that they would answer the end upon pieces of good deep land, where short drains are required, and where the stones are lying convenient, and almost ready for putting into them.

I have seen a good deal of hill land drained by this method (up and down hill) in Ayrshire, where the drains were made shallow, no deeper than they ought to have been if laid on across, but they seemed to do little good in a number of places, as, not being of sufficient depth to draw the water through the layers of the subsoil, it ran down the hill between the drains, keeping the land as wet as ever, except where thrown into them by some accidental turn or slope of the land. From all the examples which I have seen, it appears evident that right up-and-down-hill drains fail in answering the purpose intended, except where they are cut deep—2 feet at least; and when left open at this depth, except upon soils that settle down and contract, they are dangerous, and cannot be looked upon as a permanent improvement, from their being liable to fill up, and consequently requiring to be periodically cleaned out. The cost of covered drains, and the practicability of conveying material for their construction, must of necessity form an essential element in the question when judging of their comparative merits with

open drains. And as they are a permanent improvement as well as an expensive one, they ought to be made the subject of a special arrangement between landlord and tenant, as no lease of ordinary length can be expected to exhaust the improvement, and render a renewal of the drains necessary. Tile-drains upon pasture-lands are calculated to last longer than upon land under a regular system of culture, as they are not subjected to the same disturbing influences, and run less risk of being choked up by earthy matter entering the tiles.

Where tile-drains have been tried upon hill-pastures in the lower part of Selkirkshire, and where they have been cut 2½ and 3 feet deep, and 30 or 36 feet apart, the expense has varied from £3 to £3, 7s. 6d. per acre, independent of the expense of bringing forward the tiles, which will vary according to distance and readiness of access to the land. Upon other situations, where the use of the pick is seldom required to gain the requisite depth, the expense would be considerably diminished. The cost of draining an acre of the same land with open drains, in the ordinary way, and allowing the same measurement per acre as where drained with tile, would be 5s. 7d. per acre. These would require to be renewed every six or seven years, upon land of the description already mentioned, as suitable for closed drains. But the difference between the systems must not be altogether confined to the matter of outlay, nor yet to the comparative permanence of the improvement, although these must be held as important considerations in the matter. The view of the nature and extent of the improvement by closed drains must likewise be examined and taken into account; and it is here that the more obvious advantages are first seen. The land is thoroughly dried by the one system, which it never is by the other; while the pasture is both superior in quality and more abundant, and springs earlier, which is of great consequence to a hill farm. Besides, there is a very considerable saving of land by having the drains closed; and this of itself is of some importance upon a piece of low land, such as is most likely to be dried with closed drains, and which, lying upon the lower part of the farm, is available to the stock at all times, and in all states of the weather.

Apart altogether from any of these considerations, there is only a very small proportion of the sheep-pastures in a mountainous district that is available for draining with closed drains. The great proportion of the wet land must be dried with open drains. Although there are drains upon the greater proportion of the hill-pastures of Scotland, yet it can neither be said that they are all drained, nor that the drains laid on are upon the most approved principles. It does not much exceed seventy or eighty years since draining was practised to any extent in the south of Scotland, and was at first confined to a few drains laid on at a steep incline

upon some of the larger tracts of wet land. The remains of a considerable number of these early drains present a curious appearance. Being generally made of considerable length, and far between, when a spate or thaw came, they collected an immense quantity of water, which, aided by the descent given to it, formed, wherever the ground was loose and friable, an immense ditch, almost impassable to the stock at times, and altogether so when flooded with water or filled with snow. Great quantities of sand and other debris were carried down to the flatter grounds, spreading over them far and wide. Not a few of these drains remain to the present day as dry hollows. The water being diverted from them into others, and their sides having fallen in, and, in some instances, cut down and sloped, they are now grown over with grass, and have ceased to be dangerous. Others again, where set more straight down hill, and where the quality of the soil was different, still remain as deep ravines, cut down in some places to the rock through the various superincumbent layers of sand and boulder clay. The first improvement upon this system was the laying on of an additional number of drains upon the same plan. This helped to relieve the first-formed ones of a part of the water that would otherwise have flowed into them, and to a certain extent dried the land. But owing to their not being laid right across the run of the water, a great proportion of it ran down the slopes parallel with them, and consequently the character of the land was in many places little changed. Upon a number of farms in the border counties, where hill-draining was at that time practised to a considerable extent, and which have been drained of late years upon a different principle, the old drains are crossed in some places nearly at right angles by the new drains. It is not absolutely requisite in every case to make drains run at right angles to the stream into which they are to be emptied. It is sufficient that the principle of making them so as directly to intercept the run of the water is kept in view, and to keep them so level as to prevent their wearing into deep gorges and becoming dangerous. But, as I have already stated, general rules must be modified to suit the peculiar position of the land: for in one place a large tract of bog land may be found lying on a gentle slope, and so uniform in surface, that the drains can be laid off at equal distances, or at such intervals as may be judged requisite, and made to run at right angles to the stream into which they are made to enter; while in another place, not far distant, a tract of wet land may be broken up, with inequalities of such magnitude, either caused by the protruding of the rock, or by ridges of boulder clay, that each particular division, caused by these obstructions, has to be drained in a different manner, according to the form which it has assumed and the outlet that is available for leading off the water that is to

be collected; and wherever there are small patches of wet land interspersed among the drier grounds—wet hollows, or slacks, as they are called—the drains upon each particular spot must be laid on so as to suit the particular shape of the patch, and the general inclination of the land.

As a general rule, long drains are an advantage where the land will admit of their being formed, as the increased quantity of water which they collect causes a constant run, which keeps them clean, and free of obstructions. But, on the other hand, to lead the drainage of a considerable tract of wet land all into one main drain, as it may be called, when other outlets are available, is not to be commended, as it is apt either to be rendered dangerous by being too much enlarged, both in width and depth, or else at any turn, or where lying flat, to be filled up with sand and other accumulations, whereby it is rendered inadequate to contain the water, which overflows and spreads over the land on either side, and damaging it to an extent that is often rather serious; while the sand and mud thus thrown out raise plants that are very soft and unhealthy for stock, ready to induce liver disease, and consequently rot. Various instances of this may be seen upon a number of hill farms in the south of Scotland, and it is oftentimes very difficult to avoid it where the burn or stream into which the drainage of a certain tract has to be conducted is at some distance, and where the peculiar configuration of the land renders the conveying of the water to it by one drain a matter of necessity. Where land is lying level, or comparatively flat, it is requisite, in order to insure a run, to give the drains as much declivity as possible, as upon flat land the descent of the water is not always in one direction, as upon the slopes, and therefore does not require the drains to be laid so directly across in order to intercept it, and prevent it from running parallel with them. There are tracts of wet land to be met with in various quarters, so level that it is very difficult to get open drains to run, unless such a quantity of water is collected into them as forces a current by its own gravity; and it is almost impossible to keep the shorter drains, and those that collect only a small quantity of water, in such a state as to render them in any degree effective. As already stated, these are spots where closed drains would be the more efficient, but oftentimes such tracts lie so far out of the way as to render the conveyance of material (independent of expenses) almost an impossibility.

The size of drains ought to vary according to the nature of the soil and the effects which draining produces upon it. As a general rule, new drains should never be made wide except upon soft soils where the sides are apt to come together, as at each successive renewal, a part having to be cut from either side, they are ready to get too wide, particularly upon stiff clay land, where, after a series of cleanings, they sometimes assume more the appearance of a ditch

than a common drain. Another general rule, where there is not a great flow of water, is to keep them narrow at bottom, as they are more sure to be kept free of obstructions by the run of water being contracted. Where the soil is loose and friable, and ready to be worn down by the more rapid flow of the water, a greater breadth is necessary. On stiff clay and tilly land, 20 and 22 inches wide at top, 8 inches at bottom, and 14 or 15 inches deep, is sufficient size for a new drain. Upon hard tilly land, with only a few inches of soft soil upon the top, it is not possible to get to this depth without the use of a pick, but it would pay to use it, as, wherever there is much of this land lying in a wet state, rot is sure to prevail. On looser soil, and land of a soft spongy nature, a greater breadth is required, as the sides are more liable to close in, and from 24 to 28, and in some places 30 inches, is requisite; and on mossy land, 18 or 20 inches deep, as the soil, when properly dried, sinks down rapidly—in some instances to half the depth of the drain—a proportionate breadth at bottom will be required where there is a good run of water.

The breadth between drains, as well as their dimensions, has to be regulated by the nature of the soil, and the extent to which it is desirable to have it dried; even upon farms where there is a large extent of bog land, and which it may be difficult to overdry, it is not commendable to have too much land of one kind. There is no difficulty in laying good bog land comparatively dry; where it lies in a favourable situation for draining, with the soil inclining to moss, it may be all made lea-ground; but it is seldom advantageous to do so, as it is upon this land that the greatest quantity of succulent plants, suitable for spring and times of drought, are to be found, and the maintaining a proportion of land in a state suitable for retaining them, ought to be carefully studied when the question of distance is taken into consideration. Upon stiff clay and tilly soils, the drains may be laid on from 30 to 60 feet apart, and upon dry benty ridges, and clay lands producing dry harsh plants, they may be laid on between 60 and 100 feet apart, as the collecting of the fleet, or merely surface water, is all the improvement that open drains can effect upon them. On loose loam and mossy soils, except where lying flat, they ought in general to be wider than upon the stiff clay and tilly lands. Regularity can be made applicable only to such situations as afford full scope for laying on drains at such distances as may seem the most suitable; but, in a variety of situations, the formation of the land, and the manner in which the water rises to the surface, owing to inequalities or other causes, has to be the guide in the matter. In some districts, and upon individual farms everywhere, the rules to be followed are often quite arbitrary, and may be suitable no farther than to the particular spot to which they were first applied.

The time that open drains upon hill farms will run before requiring to be renewed will always vary according to the soil through which they are cut, the quantity of water they receive, the declivity given them, and the agencies in operation for obstructing and filling them up. The sides of drains in loose and mossy soil are ready to swell out with frost, and large quantities of soil fall in when a thaw comes; and where the run of water is small, and unable to clear the bottom, the deposit becomes firm and consolidated by the roots of plants that fix themselves into it, and the drains are in a manner rendered inefficient within a short time after their first formation. Some farmers clean out the bottom of new drains upon this land after they have stood the first winter, during which the frost has the greatest effect upon them. This is done at a trifling expense, and saves a more thorough cleaning out within a few years afterwards. Upon tilly and some kinds of clay land, they are ready to be filled up with what is called flying bent, and it would pay to go over drains, thus filled, every season, and throw it out, where the run of water has not been strong enough to carry it off, as by obstructing the run, and detaining all the mud that is carried down, it soon becomes a firm sod, throwing the water out of the channel altogether. Moles are perhaps the busiest agents in the filling up of drains, and the readiest in diverting the water out of them, and spreading it over the surface. The question regarding the utility of catching moles upon hill land has been often discussed, and is rather a vexed one. There is not the smallest doubt but what they improve lea-land, by rendering it more loose and porous for the atmosphere to penetrate, besides the top-dressing which it receives from the earth which they throw out, and they do the same upon bog land when it is laid sufficiently dry for them to enter it; but, on the other hand, that they fill up and injure drains, is plain to the most ordinary observer. I will only venture to remark upon the question, that I consider they do more good than injury upon the most of hill farms, and that the catching of them has been a loss rather than an advantage.

The expense of draining a hill farm with open drains must be proportionate to the amount of wet land, and the extent to which it is desirable to have it laid dry, and will be influenced, to a certain degree, by the nature of the soil rendering their formation difficult or otherwise. As examples, I shall specify several farms, varying in character and situated in different localities, giving their extent as far as known, the exact number of sheep which they maintain, and the number of roods of drain that were required to lay them dry. I may explain that the rood by which open drains are commonly measured in the south of Scotland is 6 yards or 18 feet, and the price paid per 100 roods has ranged of late years from 6s. 6d. to 7s. and 8s., according to the extent of new drains formed, and the

nature of the soil in particular places; and on account of the rise in the price of labour, the latter sum is now more generally paid. Where a pick requires to be used the price is higher—9s. and upwards. A flat-lying farm in Roxburghshire, containing 839 acres of land—a large proportion of which was wet—and keeping 540 sheep, and upon which rot was at one time very prevalent, was dried with 13,000 roods of drain. The expense was 7s. 6d. per 100 roods, or about £50. This farm was greatly improved by a thorough draining, and the stock, from being among the worst in the district, improved so much in a few years as frequently to stand at the top of the prize-lists at the local competitions; and the profits by the diminution of rot alone, would, in some seasons, amount to the value of from one-half to the whole of the outlay upon the drains, calculating from the average loss of several years previous to the drainage. Another farm in the same county, having a considerable proportion of dry pasture, extending to 1371 acres, and 1080 sheep, was drained upon the entry of a new tenant with 12,000 roods, which cost from £45 to £48. A large grassy farm in Dumfriesshire, which grazes 1500 sheep, was lately drained with 33,000 roods, which, at 8s. per 100, cost £132. I may instance another farm in Selkirkshire, extending to 1700 acres, and grazing 900 sheep, and where the land is mostly steep and dry—the wet land lying in small patches. This farm is drained with 6500 roods of drain. These were all renewed, and some additional new ones laid on some years ago, when labour was cheaper than it is now, at 6s. 6d. per 100, or £21, 2s. in whole. I shall instance only one more—a large farm in the district of Cowal, Argyllshire, where the general character of the land is steep and rocky, with the wet land lying along the bottom of the glens, and consisting for the most part of a mixture of moss and the washings-down of the rocks. The holding is 3000 sheep, and it was drained with 18,000 roods of drain, at an expense of from £80 to £84. The improvement upon the land was very apparent;—the strong rush nearly disappeared from the bottom of the glens, which became covered with fine grass and white clover. The stock upon this farm were reduced in numbers after it was drained, in order to improve their quality, as it was considered to have been overstocked in the hands of previous tenants. The stock did greatly improve in bone and condition; but there was no diminution of braxy and louping-ill, to which they were formerly subject.

I may mention, that upon none of the farms specified, with the exception of the one in Argyllshire, were the drains entirely new when the measurement was taken which I have noted. The old ones were subjected to a complete renewal, altered where necessary, and new ones laid on upon places not previously drained, or only partially so.

As the introduction and extension of draining, particularly in

the south of Scotland, has been gradual, it is almost impossible to estimate the profits derived from it; and even in the north, where a number of hill farms have been lately drained which were previously lying in a state of nature, it is equally difficult, owing to the way that accounts are kept, to obtain anything like correct data, or even to arrive at an approximation. I may first observe that, in the south of Scotland at least, *the holding of stock has not been increased by the drainage of the land.* I do not mean to say that there may not be particular farms, and parts of a farm, which now graze more stock then they did previous to being drained. Flat lying tracts, mostly composed of wet land, have undoubtedly kept more stock since they were thus improved; while, on the other hand, upon farms where there is a large proportion of dry ground, no additional stock has been kept, for, if the bog land has been improved by draining, the lea-ground has been rapidly deteriorating at the same time. But as the causes of this do not lie within the scope of this report, I will not enter into them; merely stating that, taking the pastoral districts in general, *the profits derived from hill draining must be confined to what is derived from the superior quality and sounder health of stock,* and not from any additional number that the land has maintained owing to the improvement; and it must be particularly noted, that the Cheviot breed of sheep immediately followed the draining of the land in the border counties. Without drainage a stock of Cheviot sheep could not have been kept upon large tracts which they now occupy; neither could the improvements both in form and quality of wool, which have been made upon the breed of late years, have been carried out. Both the figure of sheep and the quality of their wool are largely affected by soil and climate. The very same breed of sheep, when pastured upon dry land, will carry a fleece of much finer quality than their neighbours who may occupy wet undrained pastures. Altitude and exposure have much the same effect; for, where the stock upon the lower part of a hill farm will have close equal coats of wool, the fleeces of those upon the higher and more exposed portions, although bred from the same rams, will be more open and coarse, exhibiting a greater amount of inequality—being short on the fore-quarter, and long and coarse on the breech; and it may be remarked that, where this appearance is exhibited in the fleece, the same change takes place in the form of the sheep—they are light in the fore-quarters and wedge-shaped.

The changes wrought upon a stock by such an improvement as draining are more gradual, and not so strongly marked at first as the improvement upon a crop by the thorough drying of arable land. It is some time before the character of the land changes, the coarser plants diminish, and the finer grasses obtain the mastery. The improvement is progressive for several years, and the earlier and more

marked changes in the condition of the stock is their greater freedom from certain diseases, the improved quality of the lambs, and the superior wintering of the hoggs. The diminishing of rot is perhaps the more obvious result of draining as affecting the health of a stock. The annual loss in some districts, and upon particular farms, from this cause alone, used at one time to be very great; and this was apt to be greatly increased, either upon the recurrence of a severe season, or a mild open winter, during which there was a soft and unwholesome growth. So severe were the losses incurred, and so bad the character which the stock had obtained in the markets, that it was found difficult to get tenants to enter upon a regular lease. Upon this point I shall quote the opinion of a stock farmer in Roxburghshire, who has had extensive experience in the draining of hill land, and who is well acquainted with the effects which it has produced upon different soils, and in different parts of the country. He says, "It is doubtful if any disease has become less prevalent since the introduction of hill-draining, except rot and poverty (by poverty is meant leanness, low condition). There were two kinds of land where the stock were very liable to rot. One kind, strong spretty rich bogs, on moss and black loam, such as a great part of Eskdalemuir, where some of the best farms were so notorious for rot, that no tenant could be found to take them, one or more of them actually lay for some time without a regular tenant, and the whole district was notorious for producing the worst proving stock in the south of Scotland. Since it was drained it keeps the best, and this independently of its being at present very well farmed. However, I do not mean to say that there are now no unsound sheep in Eskdalemuir, but they are now no worse than in the surrounding districts, and there are no heavier sheep—indeed, few so heavy—in the south of Scotland."

I may observe that, in seasons when rot is generally prevalent over a district, and when the constitution of stock has been severely tried, there is a still greater loss upon those farms that were peculiarly liable to it before being drained. In regard to febrile diseases, such as louping-ill and braxy, I would say that draining has not diminished them; and as far as my information leads backward, or my own observation extends, sturdy (or water in the head) has not been much influenced by it.

The improvement in the quality of the lambs upon the wet lands, that took place after they were drained, went far to insure the better wintering of the hoggs, as they were in better order at the beginning of winter, and with a constitution better fitted to stand the rigours of that season. It is well known that hoggs winter best upon dry land; and before the general draining of the land in the south of Scotland, the hoggs were wintered by themselves upon the driest and soundest part of the farm, as it was then considered that they could

not be brought through in anything like fair order upon the more cold and wet tracts. Every one conversant with hill stock must have observed that whenever hoggs get low in condition in spring, they invariably seek after damp places, and acquire a relish for the soft plants that are indigenous to such land. Their liver gets diseased, and the desire for this food becomes a constitutional necessity, the consequence of which is a diarrhœa, which either carries them off in a short time, or, should they get over it that season, they are sure to be permanently injured, and the diarrhœa will be sure to affect them about the same time the following season. This used to be a prevailing complaint among hoggs before the general draining of the land, and was the means of carrying off great numbers, as, whenever their condition was reduced to a certain point, and the weather unfavourable, they gave way rapidly. In most instances, lean hoggs can be brought through more surely upon dry than upon wet lands.

The returns from a sheep-farm vary so much according to the character of the season, independent of market prices, that an approximate estimate is the utmost that can be arrived at. I have instanced one farm in Roxburghshire, where the saving, owing to the diminution of rot, would amount in some seasons to nearly the original outlay upon drains. And I am confident that, in the other districts where this disease was extensively prevalent, the saving would annually amount to a great deal more, besides the higher character, and higher prices which the stock now command in the market; and the additional profits derived from a finer breed of sheep, possessing more perfect symmetry of form, and carrying a superior fleece of wool. On the other hand, it is obvious to the most ordinary observer that, in the south of Scotland at least, certain descriptions of land have been made worse by over-draining—more especially the stiff clay soils. Although I am deeply impressed with the belief that there have been other agencies at work in the producing of this deterioration, yet, at the same time, it is quite apparent that large tracts of bog land have become coarser and wilder in character, where they have been closely drained, and the drains regularly cleaned out and kept running.

ON FATTENING STOCK.

By WILLIAM HORN, Brome Hall, Norfolk.

[Premium—The Medium Gold Medal.]

THE high price of beef and mutton of late has induced the farmer to find out the most profitable food for fattening stock, in conjunction with the produce of the farm. Agriculturists are too often satisfied with vague and loose statements as to what is most desirable to be used. By desire of my employer, I undertook, and carried out, the following experiments, in order to test what is most profitable to be consumed in addition to roots and hay, and I now take the liberty to lay the result before the Society.

The experiments were commenced on the 10th December 1858, and concluded on the 10th April 1859, with 7 lots of Cotswold hoggs, which were equally divided into pens of 8 each. They were bred on the farm, and, previous to this time, all fed alike. Owing to circumstances, they did not reach the weight these sheep generally attain. They were weighed on a live-stock weighing-machine when put up, and every month during the progress of the experiment. For the first month they were fed on cut swedes thrice a-day under cover, in a well-ventilated shed; the second month, on mangold and swedes mixed, in order to prevent the former scouring them; for the two last months, on mangolds alone, with 1 lb. of meadow-hay each per day, which they had throughout, with the following in addition: Oil-cake was taken as the standard money-value. The pen fed on it had three-quarters of a pound each; and each pen had value to the same amount of the other stuffs, which was procured of as good quality as could be found in the market. The following rates were paid: Oil-cake, £10, 10s. per ton; rape-cake, £6, 10s.; cotton-cake, £6, 10s.; locust or carob beans, £6, 10s.; pease, £9, 10s.; linseed, £13; bruised barley, £8. For result, see Table. It was found that each lot consumed nearly 120 lb. of roots and 8 lb. of meadow-hay a-day.

No.	ARTIFICIAL FOOD.	No. in each Pen.	Live Weight, Dec. 10.	Live Gain, Jan. 10.	Live Gain, Feb. 10.	Live Gain, Mar. 10.	Live Gain, Ap. 10.	Live Weight.	Total Gain.
1.	Rape-cake, ...	8	876	74	96	92	97	1235	359
2.	Cotton-cake, ...	8	890	62	84	89	90	1215	325
3.	Oil-cake, ...	8	884	89	108	112	104	1297	413
4.	Locusts, ...	8	860	76	92	96	98	1222	362
5.	Pease, ...	8	890	81	98	108	96	1273	383
6.	Linseed, ...	8	876	74	98	106	109	1263	387
7.	Bruised barley, ...	8	894	84	91	87	85	1231	347

REMARKS.

No. 1. *Rape-cake.*—They did not take to it at first, and often left it uneaten amongst the cut roots. Throughout they did not eat it with relish. The wool seemed dry, which is a sure indication that all is not right.

No. 2. *Cotton-cake.*—As will be observed, this lot made least weight of any. The cake was eaten with apparent relish, but the appearance of the sheep was not satisfactory.

No. 3. *Oil-cake.*—This lot went on well all through. Wool soft, and every indication of doing well.

No. 4. *Carob Beans.*—These were consumed with avidity. The sheep went more to bone than fat, and in my previous experience I have found these more profitable for store than fattening beasts. All kinds of stock relish them—horses, cows, or pigs. For brood sows, I have found them very good when soaked in water. It is worthy of remark that the pen fed on them consumed one-eighth less roots than the others: their more bulky nature accounts for this.

No. 5. *Pease.*—Went on favourably all along. But the wool wanted the oily handle which those fed on oil-cake or linseed had.

No. 6. *Linseed, bruised.*—At first they did not relish it, nor until it was mixed with some chaff; latterly they went on favourably, with every indication of doing well.

No. 7. *Bruised Barley.*—This lot went on slowly; the wool hard and dry. It seemed to be too hot for the constitution.

EXPERIMENT ON FATTENING CATTLE.

At the same time that the above experiments were going on, six bullocks, bred from Ayrshire cows, by a shorthorn bull, were put into single boxes. Two were fed on each of the following: Bruised linseed, ground wheat and barley in equal parts, and oil-cake; each was mixed with some damped chaff. For result, see Table.

No.	Artificial Food.	No	Live Weight, Dec. 10	Gain, Jan. 10.	Gain, Feb. 10.	Gain, Mar. 10.	Gain, Ap. 10	Live Weight.	Total Gain.
1.	Bruised linseed, . .	2	2716	150	188	200	180	3434	718
2.	Ground wheat and barley, . .	2	2688	138	166	187	178	3347	669
3.	Oil-cake, ...	2	2754	140	150	167	180	3391	637

The same rule was followed as in feeding the sheep—oil-cake was taken as the money standard; 5 lb. was allowed each bullock, or 10 lb. each lot; the other ingredients to the same value, which I may repeat: the price per ton, oil-cake, £10, 10s.; wheat and barley meal mixed, £8, 15s.; linseed, same as before, £13. It was found

that each bullock consumed 90 lb. of roots, swedes, and mangolds, and 6 lb. of meadow-hay daily. Each lot was healthy, and gave every indication of doing well; although, on reference to the Table, it will be found that linseed produced most weight, and oil-cake the least. From close observation during these experiments, I should be inclined to give the preference to linseed ground and mixed with some bulky substance, such as bran. It gives the best result with the cattle, and I have every reason to believe it would have done so with the sheep, but they did not relish it alone. These experiments were undertaken by desire of my employer for our future guidance. They received every attention in order to elicit the truth.

ON RED-WATER IN CATTLE.

By George Poyser, V.S., Ashbourne, Derbyshire.

[Premium—The Gold Medal.]

Red-Water, a disease affecting members of the bovine tribe, is a convertible term for foul water, black water, &c. It has been called by a name which, to the professional man, indicates more of its nature, if not its true pathology. This is a compound term, first employed by the talented and esteemed lecturer on Cattle Pathology at the Royal Veterinary College of London, to designate a disease so variously named in different parts and provinces of our empire.

That *hæmo-albumen-uria* is a very descriptive and comprehensive term, will, we think, be gleaned from the following remarks:—

Hæma, the blood; hæmatosine, the colouring matter of the blood.

Albumen, from the Latin albus, white. It is constituent of the blood.

Uria is from the Greek, denoting the act of urination, and its compounds indicate the abnormal action of that function.

By *hæmo-albumen-uria*, we therefore understand a diseased flow of urine, in which albumen and hæmatosine, in some form or other are constituents; but to make clear the ideas we entertain of the pathology of this disease, we consider it necessary to make a digression from our subject into the nature and formation of blood. Blood is a fluid circulating through the animal frame, carrying with it the powers of support, secretion, restoration, regeneration, and heat. It is capable of maintaining in any media in which an animal may be placed a temperature of 99° Fahrenheit. Its specific gravity is greater in robust and male, than in feeble and female animals, by reason of its containing more solid

matter. It is red in the vertebrated, and colourless in the invertebrated, except in some cases of earthworms. It requires a more complex digestive system for its production from vegetable than animal food.

It will be needless for us to trace the process of blood-formation beyond the commencement of the lacteals. According to the researches of Professor Goodsir, of Edinburgh, after the chylification of the food has occurred, the epithelial covering of the mucous membrane of the intestines is removed, by which the looped and pointed ends of the lacteals come in direct contact with the chyle to be absorbed. This process is doubtless effected in obedience to endosmotic laws and capillary attraction. In the lacteals, chyle is found to be an opaque, white fluid, containing fatty-matter, oil globules, albumen, numerous molecules of granular matter, and possessing a saltish taste, and an alkaline reaction. After it has passed the mesenteric glands, it appears to possess all the properties of blood except colour, and to have become vitalised by its contact with those organs—viz., it will clot, separate into its constituents, and yield to other tests; thence it goes direct to the right side of the heart, to take its part in the important function of augmenting animal life.

But as Lewes, in his *Sea-Side Studies*, very aptly remarks,—"We are erroneously accustomed to consider blood as the final stage of food, previous to assimilation. Physiologists trace the story of digestion up to this point, and there leave it, as story-writers leave their heroes married, thereby indicating that nothing more remains to be said. But just as marriage is the beginning of a new act in the drama, and the act in which all life culminates, so is this blood-formation but the commencement of a new series of changes, and these the most important. I think it can be shown that the blood itself is not more immediately and directly assimilable than a mutton-chop," or a truss of hay, "from which it may be formed." He adds, "that in its passage through the walls of its vessels, it undergoes specific changes, fitting it for assimilation; without such changes it is not assimilable; blood as blood nourishes no tissue, but lies on it like any other foreign substance, which must be got rid of by reabsorption into the veins, as when we see a vessel ruptured and the blood gets deposited in the parenchyma."

Serum of blood is found to be composed of water, albumen, and soluble salts.

The *clot* contains fibrine and red and white corpuscles.

Of water we need not speak.

Albumen appears to us to be the most important component of blood; it is to this substance that serum owes the property of coagulating when heated. It is the starting point of all development, evolution, and growth. It is the chief constituent of animal tissues, especially integumental and epithelial ones, and the basis

of whole series of peculiar organs, especially those that are the seat of vital actions. It is the active constituent in the early stages of fœtal development, the essential element of corpuscular and cell-formation (because it is nearly identified with the contents of cells), and the real regenerator of the animal frame. Its origin is in the plastic constituents of food; and it appears to be analogous to, if not identical with, vegetable albumen, and convertible into fibrine of blood, and fibrine and albumen of flesh.

The salts of the blood are composed of the carbonates and phosphates of potash and soda, the alkaline earths (lime and magnesia), iron (oxidised), and common salt (chloride of sodium).

These incombustible constituents are of great importance in the animal economy. They are acquired by the animal from the food it obtains, and it has been proved by repeated experiments of eminent physiologists that animals, fed on a single or a mixed diet, from which these incombustible ingredients had been extracted, soon exhibited all the appearances of starvation, and are utterly unable to support life. These salts are essential to the processes of digestion, assimilation, respiration, and secretion; and it is by their presence that the plastic constituents of the blood receive oxygen, and are rendered tributary to the processes of nutrition and the production of animal heat. It is on the presence of a free alkali, or an alkaline salt in the blood of all animals, that the solubility of its fibrine and albumen depends; consequently the fitness of blood for the sanguification of the tissues, and the maintenance of all vital phenomena.

Fibrine is that constituent which causes blood to assume a solid form when drawn from the veins of an animal. It makes a mesh or network that envelopes the corpuscles in the clot. It is thought by some to be a more highly-developed form of albumen—in other words, to be albumen elaborated and vitalised, and so to stand next for appropriation into the tissues. Its property of settling in a solid form has been thought by some to be a vital endowment, and by others to be its death, or *rigor mortis*. While, on the other hand, some have gone so far as to consider it as an effete material, which, instead of standing next for appropriation into the tissues, is in process of elimination from the system, and that it has reverted to the blood from a waste of tissue, or has arisen from its own decay.

We confess that to us the latter conclusion appears infinitely more plausible. The arguments we find in favour of it are these: —That fibrine is constantly increased by inflammatory actions, under many circumstances of exhaustion, weakness, and inanition, during the progress of starvation, although in some of the latter conditions it seems to have lost some of its density.

The researches of Messrs Andral and Gavarret into the comparative physiology of the blood, have shown that an improvement in

the breed of animals always tended (*cæteris paribus*) to increase the proportion of coloured blood corpuscles, and to diminish that of its fibrine. We also find further indications of the same inverse ratio between the amount of fibrine and the perfection of blood in the facts, that there is little or no fibrine in the blood of the fœtus, none in the egg, and less in the blood of carnivora (who feed on it) than of the herbivora. We also find from Liebig that fibrine (chemically) is albumen to which oxygen has been added, and that it is highly probable it may be derived from a waste of tissue, or an oxidation of blood.

The *white corpuscles* are supposed to have their origin in the epithelial cells, found in the interior of mesenteric glands; they are spherical in shape, have a diameter about the 2500th part of an inch; they have a nucleus containing granular and fatty matters, and have a power of changing albumen into plastic or organisable lymph. They are compressible, and so can pass through small vessels in the first stages of inflammation; they are more numerous in animals whose blood is very nutrient, which may be considered as only augmented nutrition. Their ripeness and rupturing, liberating the nuclei, is supposed to be the origin of the red globules. From their affinity for the coats of vessels, to which they are often found adhering, they appear to be intimately connected with nutrition.

Red corpuscles.—It is to these bodies that the blood of all vertebrated animals owes its colour; they stand next to albumen and the white corpuscles in importance; they are of greater specific gravity than any of the other components of the fluid.

About 130 parts are found in 1000 of the blood of males, and 120 in the same quantity of the blood of females. They may be slightly increased or decreased without materially interfering with health, but their vitiation is highly injurious. In all mammals, except the camel, they resemble in shape a flattened disc; their size in the cow is about 4500th part of an inch in diameter; they are smaller in the herbivora than the carnivora, and possess a nucleus only during embryonic life. They are composed of globuline, hæmatosine, salts of blood and iron, on which latter their colour was erroneously supposed to depend, but in hæmatosine is found the colouring principle. They appear to be influenced by the presence of oxygen and other gases, and are thought by some to be the carriers of oxygen into, and carbonic acid gas out of, the system; they have a power of absorbing oxygen, and become of a bright scarlet colour under its influence. Hence they are thought to be mainly instrumental in the production of animal heat.

They are easily dissolved by water, yet they remain uninjured in the fluid portions of the blood. This seems partly due to the presence of saline matter, and partly to that of albumen, for they are alike insoluble in a strong solution of salt and a highly albuminous fluid.

We have shown, in the course of our remarks, that on the saline alkalinity of the blood the solubility of its albumen and fibrine depends—that in no other medium than a saline albuminous fluid can the red corpuscles maintain their integrity and functions—that the specific stimulus of cell-growth is a material identical with, or convertible into, the natural contents of such cell—that the densities of fluids are altered by the quantity of salts. Thus it is that endosmotic laws are fulfilled, cell-development effected, nutrition and secretion carried on. We see, therefore, that the serum of blood constitutes the universal material of growth, not only for the cell-development, which constantly advances within these fluids, but also for all organic increase within the body; hence this material being directly derived from food, may become impregnated with any morbific influence, or an unhealthy digestion, and assimilation lead to the production of deleterious organic acids. Thus from the complex arrangement of the elements of vegetable substances, the blood, by its own powers of development, becomes the cause of further effects, and generates its own decay.

And, although we know the blood to be exceedingly jealous of the introduction of any substance foreign to its composition, and we cannot but admire the contrivances of nature to sustain its purity, yet, nevertheless, the annals of pathology inform us of numerous instances and methods in and by which its vitality is partially or totally destroyed. We have the absorption of poisons from the skin and tissues, or through the lungs, and the poisonous and prejudicial effects of aliments, &c. It is easy, therefore, to see how, by the quality of food or abnormal assimilation, the baneful effects of substances may be exerted on the blood, to end only in the production of disease.

Having prefaced our article with some of the leading characteristics of blood, we feel that we shall be able to convey a clearer notion of the pathology of the disease under consideration. We do not think it within the province of this report to recapitulate the ideas that have been entertained by various writers. The opinions and the means of cure have been very various; but still a very striking coincidence has run through all the accounts we have read with regard to the treatment—a fact we shall refer to under the head of remedial and preventive measures—that is, the recommendation of the use of common salt.

It is to Professor Simonds, of London, that we owe the most enlightened views of the true pathology of the disease. With him, we hold that this is a disease of the blood, primarily caused by derangement of the stomachs or bowels interfering with the function of the liver; or that this organ is first affected, ceasing to purify the blood and secrete a proper and due quantity of bile, thereby disturbing the process of assimilation, inducing an altered condition of the vital fluid, giving rise to the separation of its albumen and hæmatosine by the kidneys.

That the urine of animals affected with this disease contains albumen, and that, too, in large quantities, is shown by boiling, or by the addition of nitric acid to it; either of which processes will cause an abundant precipitation of white coagulated matter, well known to be albuminous. Its colour is also dependent upon the presence of hæmatosine and iron, for both can be detected in it. Blood as blood is not present, or we should be able to detect its fibrine, and, by the microscope, the characteristic red corpuscles; for, as we have stated above, they are capable of maintaining their integrity in saline albuminous fluids.

Post-mortem appearances, so far as our researches have extended, have not revealed any injury of the vessels of the kidneys, whereby these bodies could escape. The abnormal appearances on examination have invariably been an hypertrophied, dilated, and discoloured condition of the principal conduits and secerning vessels of the gland, plainly indicating that the globules are broken up previously to their transudation by the organ. The liver is generally engorged and softened, and the whole mucous surface of the small intestines present appearances of inflammatory action more or less intense. The tissues in the neighbourhood of the kidneys and bladder, and, in fact, the lining membrane of all the principal blood-conduits throughout the body, appear as if coloured by a solution of chocolate. This tinge is doubtless caused by the abnormal condition of the blood, followed by an undue stimulating effect; hence it is that in the progress of this affection we find the symptoms which increase most in intensity are those which indicate the state of the nervous and circulatory systems.

If this urine be allowed to stand for a day or two, it not only exhales a very offensive effluvium of decaying animal matter, but deposits a sediment which consists chiefly of the matter derived from tissue, epithelial cells, and scales, also crystals of the oxalate of lime, and the triple phosphates of the alkalies.

It is usual for the organic acids introduced into the blood through vegetable organisms, as neutral or acid salts, to be as completely burned (oxidised) as in a reverberatory furnace; but, to effect this process, the presence of a free alkali in the blood is essential. And, as alkaline carbonates are known to predominate in the blood of herbivora, so ought we to have, in a normal condition of the urine, carbonates of the salts of the organic acids. Hence it is that Dr Golding Bird has demonstrated that the presence of the oxalates in human urine can be clearly traced to mal-assimilation; and as the channel of egress for the phosphates from the blood of herbivora are the bowels, their presence in the urine is another proof of organic derangement.

Symptoms.—The disease of red-water is usually ushered in by diarrhœa, which is doubtless an effort of nature to rid herself of an irritant, after which the functions of the bowels generally become

entirely suspended; and we are curious to know how far this suspension of their functions may be the cause of the disorder. But it is seldom, very seldom, that this early symptom of the disease is noticed. The skin now gives, or it may have given, for some time past, indications of a deranged condition of the alimentary tract, by a staring unhealthy appearance, and a harsh ungenial feel. The animal separates from the rest of the herd, is often very restless, has a haggard expression of countenance, arched back, and a distended, or lank condition of the abdomen. In no disease more than in this do the eyes become so speedily sunken, and retracted within their orbits, or the tissues of the body more rapidly wasted, giving the animal a very dejected appearance. It is highly probable that the animal may be found lying down, as there appears an inclination to assume a recumbent position, caused doubtless by lumbar sympathy with the derangement of the kidneys.

If we examine a subject of this disease more closely, we find a difficulty of breathing, pulse accelerated, artery contracted—giving a hard vibratory motion to the pulse—the secretion of milk is diminished, or entirely suspended, the act of rumination has ceased, the nose dry, and other indications of fever. We generally find the bowels constipated, the small portions of dung occasionally voided, are hard, and coated with mucus; and the urine of the characteristic colour giving the name to the disease. The peculiar pulse, and the increased or morbid sensibility of the animal, are caused, we think, by the poisoned blood, by its containing more than its due proportion of fibrine, or less of its proper diluent the serum, and by its having in this vitiated condition a stimulating effect on the heart and arteries, analogous to inflammation. Hence our great object in treatment is to dilute the blood with a saline albuminous fluid.

As the disease progresses, respiration becomes more and more hurried, the pulse quicker, smaller, and of a wiry character; the urine is voided in smaller quantities, and at more frequent intervals, and urination seems to cause more pain and irritation. The urine is blacker in colour, and thicker in consistency; the animal moans, gives other evidence of abdominal pain, and about the third or fourth day sinks, vitally exhausted, a victim to the malady.

Sometimes during the progress of the disease we have seen an intense thirst arise; the animal drinks freely, and seems relieved; functional activity is partially re-established, and the affection seems to assume a less acute character.

Under these circumstances we have witnessed rumination again partially performed; the pulsations decrease in frequency (although they and the heart still preserve the vibratory motion), respiration is relieved, the bowels slightly or fully respond, the urine

becomes thinner, and more free from gritty matter, but still dark in colour, its smell less disagreeable, and its alkalinity slightly increased. Although nature seldom fails (with a little medicinal aid, or by good nursing alone) to re-establish a normal condition, she may yet succumb, or structural alteration of the kidneys may ensue.

This sub-acute form of the disease may be the primary state of things, or it may follow an acuter stage. It has been considered by most writers as a distinct affection, requiring different treatment; but to this we cannot subscribe, as we consider it dependent upon the same functional inactivity and derangement. Surrounding circumstances or collateral treatment, may, however, have mitigated the severity of its rapid and untoward effects upon the system.

As the liver and its secretion are on all hands allowed to play an important part in the digestion of food, the function of the bowels, and the purification of the blood, it is only a natural conclusion that disease must, even from the first, to some extent exist in this organ. But, on the other hand, we have the evidence that the distinct and unassociated affections of this viscus are not followed or accompanied by anything analogous to red-water. So are we justified in seeking elsewhere for complications, as well as a cause. According to our pathological experience of all organs in the body immediately connected with the more important offices, the liver is most tardy in yielding unequivocal indications of a derangement of its function. It is therefore in the sub-acute form alone of the affection, we have time for a development of the evidences of hepatic complications. Now is it, then, that we have the visible mucous membranes of a yellow colour; the white, and even the coloured proportions of the animal's skin bear the same jaundiced aspect, while the urine will often mark with a yellow stain anything white.

Causes.—The indirect or predisposing causes of this affection exist in anything having a dyspeptic tendency, or at all interfering with the functions of the chyle-forming viscera, or the production of normal blood.

It seems most prevalent in the wet and warm weather of spring, summer, or autumn. It is most frequently seen in animals that are depastured on barren and heathy moors, in woody districts, on swampy plains, and cold clayey soils; also on hilly tracts in which low and stunted shrubs, especially the sloe-tree, abound. It may be caused by animals browsing upon the foliage of trees or hedges. We have known it to succeed the change from a poor to a luxuriant pasture, especially when cold nights and frosty mornings prevail. *

* The disease is still generally known in Scotland under the name of "muir-ill," a term, in fact, which pretty clearly indicates the character of the land where it prevails. Both wet and dry soils of an inferior description are equally subject to it.

On such elevated tracts as above-mentioned, in hot dry summers, we have known it to rage as an epizootic malady, and although not a contagious disease, few members of a herd have escaped its effects. The dyspeptic tendency of grasses under these circumstances is doubtless the cause. Or it may be that, during the wet and warm weather, in which we know this disease to prevail, the superabundance of water may cause plants and grasses to become impregnated with the properties of soils not usually taken as their food. We know, from experience, that tubers grown with excess of moisture are very liable to a premature decay; also plants developed in such a medium may be subject to speedy decomposition. Also, the bitter extractive principle of certain grasses, so necessary for the digestion of gummy matters in the intestines of herbivora, may, at certain periods, and under certain circumstances, be very deficient.*

Extensive experience has shown that cattle, removed in wet seasons from high limestone lands to a sandstone soil, almost invariably contract the disease. It is rarely seen on light marly land, and never seen in cattle that drink the waters of the river Dove, a mountain stream arising chiefly from limestone springs, and flowing through the romantic Dovedale, well known to Cotton and Walton, as it is to most of our modern anglers.

We have seen it in calves, stirks, steers, and bulls, but most frequently in cows. We do not think that it is a disease at all connected with pregnancy or parturition. These conditions may impoverish the blood, increase the liability to dyspepsia, but in no direct manner do they induce it; for it is a disease quite distinct from affections of the uterus; neither do we think that red-water, or hæmo-albumen-uria, is ever the result of injuries sustained during either copulation, pregnancy, or parturition, or indeed under any other circumstances; but that it is entirely attributable to functional disorder and mal-assimilation.

Like the red-water of sheep, in which the serous parts of the blood, with some of its colouring, are thrown out into the abdominal cavity of the animal, the quality and properties of food rank foremost among its causes. What may be the precise condition of the viscera, or the food presented to them, giving rise to this ab-

It no doubt arises from deficiencies in the nutritive qualities of the grasses, which are produced by a want of a due supply of those earthy matters that plants require. The weakened constitution of the animals is, as might be expected, subjected to a severe trial after the birth of the calf; consequently, the disease in cows generally makes its appearance shortly after this period. A good dose of common salt, or sulphate of magnesia, with a little ginger, a few days after calving, is a preventive, which should not be lost sight of in all those districts where the disease prevails. The fact of the disease not being known where the waters are impregnated with carbonate of lime, as stated by the author of this report, is an important one. —Ed.

* The latter supposition is by far the most probable.—Ed.

normal state of the blood, in the present state of our knowledge it is difficult to determine; although the symptoms and pathological conditions accompanying this disease, such as difficulty of breathing, wasting of the tissues, engorgement and softening of vascular organs, and the disintegration of blood-corpuscles, are consecutive to the slow and persistent introduction of an alkali into the blood of animals. We do not, in red-water, find the dissolved condition of its plastic constituents, or its inability to settle in a solid form, but rather an undue amount of fibrine in the blood, and the characteristic discoloration of the urine.

It may be that the oxalates, well known to be the chief saline ingredient in wood sorrels, and other plants generally found in places where the disease is most prevalent, by excessive admission into the blood, begin the work of devastation.

Oxalates belong to the class of acid salts, and no doubt, like their basic acid, possess properties poisonous to animal life. It must be remembered that the action of oxalic acid is very peculiar. According to Christison, unlike the mineral acids, when diluted so as to lose its irritant properties, it still retains its poisonous ones. Those who may object to the possibility of oxalic acid being assimilated, will find from our best authorities that all the organic acids are, to a greater or less extent, taken up by the blood, and that, by the normal alkalinity of that fluid, they are consumed, and thus rendered contributory to the production of animal heat. Chemistry also teaches us that, by the addition of an equivalent quantity of oxygen, in replacement for the hydrogen of sugar, we convert that substance into oxalic acid. As, therefore, the preparation of saccharine matters in the blood for the process of respiration depends upon the liver, it may be that it allows, owing to functional disorder, the formation of oxalic acid, instead of the production of the necessary hydro-carbons. Although such may be the case, we are not aware that oxalic acid, when given to animals in cases of experiment, in a distinct form, in large or small doses, was ever known to produce similar effects to those seen in red-water. This, however, may be owing to the resistance of the *vis-vitæ* of animals, or to the absence of that undefinable condition of the chyle-forming viscera, which is the starting-point of functional disorder and mal-assimilation. Doubtless, the evolution, secretion, and growth of animal organism is brought about by the constant presence of opposing chemical agencies, presided over by a vital formative power; and it is highly probable that they are those most universal, and to us appear to be the basis of all the laws of chemical action—viz., an acid and an alkali. As Coleridge says, "life is not a thing, but an act and process;" so are all the phenomena above-named but the manifestations of agencies producing the individuation; so a perverted condition of the chemical forces causes those manifestations to become abnormal. The fibrine

of the blood may represent all that is acid in that fluid, and the albumen all that is alkaline.

But whatever it be, whether oxalic or gallic acid, or any other organic production, or only an alteration in the dynamical condition of fluids, or their constituents (*katalysis*), it is something which has the effect of altering the due proportion of blood-elements, partially, if not totally arresting cell-development, destroying the correct alkalinity of the blood, interfering with, altering, and arresting the secretions and functions of the animal system.

Preventive Measures. — Vegetable chemistry is a high and mysterious science, and although the laboured researches of able and gifted investigators in this field have taught us many of the essentials of vegetable life, the glimpses which they have obtained into its wonderful nature are few and imperfect. The precise laws of combination observed in the union of inorganic substances seem to be in a measure replaced by a force allied to vitality in the chemistry of vegetables: thus, when elementary bodies are united in given proportions—the product, which in inorganic chemistry would be known—in organic, is totally uncertain.

But although we have learned how prone the elements of complex organic substances are to enter into new combinations, we yet know literally nothing of the effects which the new series of compounds may have on animal life.

It is, therefore, in a measure useless, in the present state of our knowledge, to theorise more on the probable cause of this disease and its mode of action; we shall, we conceive, be fulfilling the purpose of reports of this nature best by pointing out the measures to be taken for preventing or lessening the severity of this disease.

To lands on which it is frequently occurring, we would apply efficient drainage, if required, scour the ditches where noxious plants may grow, remove the low shrubs to which we have made allusion, and try to alter and improve the quality of the herbage. If the grasses are coarse and rank, we would dress them lightly with gas lime, a recently-discovered manure, obtainable for a few shillings per ton at any gas-works in the United Kingdom. It is the anhydrous oxide of calcium, or dry powder of lime, through which coal-gas has passed for its purification. Its effects, as well as common calcined lime, are very potent upon both grass-lands and arable. When applied to grass-land where the herbage is rank or sour, both seem to have a great corrective influence; for after their application, cattle will eat with apparent relish what they would not previously touch.

Lime, in some form or other, would appear to be a useful manure as a preventive of red-water.

We shall place no limit or restriction on the use of good farmyard manure, for we have never yet seen a case of red-water on land in good condition.

We would occasionally cast a lump or two of quick-lime into water-pits, especially on clayey or sandstone soils, and leave, in sheltered spots, rock-salt, of which the cattle might partake at pleasure.

It is with some confidence that we recommend the adoption of plans derivable from the foregoing remarks, being convinced that red-water, or hæmo-albumen-uria, is a disease gradually disappearing before the drainage and cultivation of land. Unlike most other diseases, artificial habits and food are not the most fertile sources of it, but would rather appear as preventive agents. It is, therefore, to efficient drainage and cultivation, more correct knowledge of the use of artificial and natural manures, a more extensive acquaintance with the benefits derived by cattle from a mixed or condimental diet, that we must look for a mitigation, if not a total annihilation, of this disease.

Remedial Treatment—Under this head of our subject we shall allude to the remedy we have before mentioned. The result of our gatherings and inquiries, whether from professional or non-professional sources, is that no remedy can vie in popularity and general adoption with common salt (chloride of sodium) As to the use of every other remedial means there seems to be the greatest discrepancy of opinion. It was to the universality of this remedy, in some form or other, whether as cured herrings, bacon, brine, &c, that our attention was first directed. We have tested the efficacy of what is so generally believed to be a panacea for this disease, and we cannot but add—after a varied and extensive use of it—our voice to the general approval. When judiciously given, combined with other measures, it becomes a powerful auxiliary in the treatment of this and many other diseases We have only to refer to Liebig's latest published letters on chemistry to understand its *modus operandi*, and become forcibly impressed with the vital importance of this substance to the well-being and development of animal life

If we were to refer to the different modes of treatment that have been taught and practised by various writers and authorities on the subject, we should be giving details from which we should be unable to deduce any principle to assist our discussion.

The indications of cure, according to our pathological notions, would be these:—To correct the condition of the liver, and all the chylopoietic viscera, to dilute the blood, replenish its wasted constituents, and restore its normal alkalinity; to allay the morbid nervous excitability, to foster nature by genial restoratives, such as warmth and good nursing; to endeavour to renew the suspended activity of the skin, and thus relieve the overtaxed kidneys, and gradually to replenish the animal's exhausted powers by tonics and a liberal diet.

To follow out the above indications, if called to treat a case, we should begin by administering to the animal—

℞.	Chloride of Sodium, ...	℥ iv.
	Acetated Liq. Ammonia, . . .	℥ iv.
	Aqua, ...	O. jj.
	Mft. haustus.	

This we should give with the idea of inducing thirst and reducing fever, whereupon we should allow the animal to drink as much mucilaginous fluid, such as a decoction of linseed, as it pleased. Restore warmth by rubbing, clothing, and bandages.

We should now begin to think of laxative medicine, and we have found the following formula very beneficial:—

℞.	Calomel, ...	ʒ ss. to a dram.
	Bbd. Aloes in Sol., ...	℥ viij.
	Sulphur, ...	℥ ij.
	Sulp. Magnesia, ...	℥ xvj. to ℥ xx.
	Mft. haustus.	

well mixed in two or three quarts of gruel (of which salt is a component), and when of a proper temperature, carefully horned into the animal. If the extremities and skin of the animal are cold, in addition to the rubbing and clothing, about two fluid ounces of spirit of nitric ether may be added with advantage to the draught. Half the quantity of the above purgative dose may be repeated in twelve or twenty-four hours, as it may be deemed necessary, and to it may be added, if thought expedient, from thirty to sixty drops of croton oil. But it must be remembered in the treatment of this affection, that we have little or none of the watery elements of the blood to spare, consequently, we should avoid those purgatives that induce fluid evacuations from the bowels; indeed, in most cases of stomach and bowel affections of cattle, bulky evacuations are always followed by better effects than watery ones, and therefore, to push such purgatives as the sulphate of magnesia and croton oil too far, would be detrimental to our purpose.

The propriety of bleeding in this disease is a vexed question with pathologists. When, however, the animal has a full hard pulse, difficulty of breathing, and its condition and other circumstances appear to warrant it, we have seen bleedings, not exceeding one or two quarts, followed by beneficial results. While abstracting blood, keep the hands on the pulse and heart, and on the first falter of either, stop the flow: two or three pints will seldom fail to produce it. If you induce syncope or fainting, your patient will seldom rally. Bleeding here is not done to reduce any inflammatory action, but to relieve the circulation of its altered fluid, unload glandular congestion, induce lacteal and venal absorption, thus dilute the blood, and be a means of freeing it of some of its impurities. We have often thought, where it was warranted, that it has been the starting-point of renewed functional action, that it has materially assisted the absorption of fluids, the action of the bowels, and in turn the clearing of the urine. But the pur-

pose of bleeding, and the circumstances which warrant it in this disease, should never be lost sight of. There is no doubt that the excited state of the nervous system, the circulation, and the heart's action, are due to a want of proportion in the elements of the blood, producing a state analogous to inflammation, but, as we see, differing essentially from it.

When we think we have pushed our purgatives to a reasonable extent, and have yet no response of the bowels, we would recommend that half-ounce or ounce doses of the sesqui-carbonate of ammonia, with a little common salt and ginger, be given every six hours in gruel, so as to arouse the functions of the stomach and bowels. We have often seen a turpentine emulsion given, and followed by good effects.

℞.	Oleum Terebintha, ...	℥ iv.
	Decoction of Linseed, ...	O. jj. (2 pints.)
	Mft. haustus.	

We have given, with very good results in many cases where the bowels have responded, but the urine and other symptoms remained nearly equal in urgency, the following "Febrifuge" medicine:—

℞. Ext. Belladonna, ... -	ʒ i
„ Gentian Radix, ...	ʒ ii.
Spt. Nit. Æther, ...	℥ i or ℥ iss.
Ligr. Amon Acet., ...	℥ ii or iij.

Mft. haustus, and mixed with a pint or a quart of thin gruel, and repeated every twelve hours.

The acetated ligr. ammonia is a good medicine. It is given with great benefit in many typhoid and abnormal conditions of the blood, and when slightly alkaline, it has the effect of neutralising any acetic tendency of that fluid and the bowels.

Watery, and even spiritous tinctures of belladonna, or hyoscyamus, may be given to allay the exhausting, nervous, and vascular irritation usually present.

In discussing the treatment of that phase of the disease, which we have called sub-acute, instead of chronic red-water (having arisen out of the partial amendment of a severe case, or from favourable circumstances in the condition and hygiene of the animal having been prevented from ever merging into one), we must keep in mind the hepatic complications invariably present.

After the acute or sub-acute form of the disease has existed for three or four days, and sometimes even from the first, we have unequivocal indications of deranged function of the liver, by yellowness of the skin, and visible mucous membranes, a cordy character about the pulse, sometimes the fœces will be clay-coloured, or otherwise wanting in their characteristic normal tinge. In these cases we would blister on the right side of the abdomen, over the region of the liver (first cutting the hair closely off the skin), with the following ointment—

℞. Ungt. Cantharidin, ... ℥ i.
Ungt. Mercurialis, ... ℥ i.
Mft. Ungentum, which rub well on the skin for twenty minutes.

Give as much of the purgative medicine first recommended as may be deemed necessary, and restrict the animal to a light nutritious diet, with plenty of gruel and mucilaginous drinks.

The febrifuge medicine may be here given with great advantage. Rubbings, clothing, and bandages will be necessary, as a free action of the skin is always most desirable. Being a great emunctory of the body, it is able to relieve the kidneys very extensively in their office.

As a rule, bleeding will not be called for, or the period for its beneficial adoption will have passed.

After two or three days the bowels may or may not have responded, and the animal may seem but slightly if at all improved, the water still very dark, although voided in fair quantities, the yellowness of the membranes even more intense, and the depression of the animal more and more palpable. We will admit that this is a stage of the disease in which we have been apt to despair. But we have often given, with the happiest results, the following combination :—

℞. Iodide Potassium, ... ʒ i.
Chloride Sodium, ... ℥ i.
Pulv. Gentian Rad., ... ℥ i.
„ Ginger, ... ℥ i.
Mft., and administered daily in a quart of ale.

Feed with a succulent nutritious diet, such as pollard, or bran-mash, malt-mash, a little lucerne, clover, or meadow-hay, with plenty of mucilaginous fluids for drink.

The iodide of potassium seems to have a wonderful effect upon organic action, when functionally or even structurally affected. It is given with marked benefit in several diseases of both horses and cattle, even when there is great prostration of strength and wasting of tissue.

The salt and gentian correct the condition of the alimentary tract, and thence of the blood; so that the combination is theoretically advised, and we know it to be practically beneficial.

Therapeutists may cavil at the introduction of so many diuretics into our treatment; but practice has long since clearly demonstrated their utility, and the tolerance awarded to them in cattle pathology.

In penning these remarks, we do not pretend to have exhausted the subject, or delineated its true pathology; but we have endeavoured to be concise and intelligible in showing what we deem to be a more correct conception of this affection.

If we have borrowed from any unacknowledged sources, we have done so unwittingly.

ON THE LOSS OF SHEEP IN 1860.

By PETER JOHNSTONE, Alton, near Moffat.

[Premium—The Silver Medal]

THE summer of 1859 was unusually dry, and often cold at night, with slight frosts, which retarded the growth of grass on high lands, so that in autumn sheep stocks were generally not in their usual condition. The winter setting in so early as the 25th of October with a great fall of snow, followed with severe frost, completely stopped vegetation, and injured the grass, more especially the growth of the autumn rains. This circumstance must be considered as leading to the great loss of sheep which took place in the following spring. The snow, in high districts, never altogether disappeared from the 25th October till the end of April; and there was little vegetation, even in low land, till the middle of May.

The districts which suffered most were eastward of Dumfriesshire, including the eastern part of it, and part of Lanarkshire. There was comparatively little loss in blackfaced sheep in the western counties, neither was there any loss of blackfaced sheep even in Dumfriesshire, Lanarkshire, nor indeed south of the Forth. The districts and farms which suffered most, in the eastern counties, are considered the best grass-lands for Cheviot sheep, and where they were first introduced, and whence they spread gradually westwards to Dumfriesshire and Lanarkshire. There the loss has also been heavy, and where the land is generally more grassy. It was originally soft, wet, marshy land, where the drainage of sheepwalks first commenced, and made such a marked improvement on the pasture and flocks of sheep. When draining sheep-farms first commenced, farmers were very careful in keeping the drains at a good distance apart, and also confined them, generally, to the wettest and lowest bottom-land, which had a most wonderful effect in improving the pastures and sheep. But then farmers thought greater improvement might still be made by draining, and commenced draining the hill-sides, where wet, whether bent or moss land, and also laid the drains more closely together The bottom-land also had often one drain put betwixt each of the old ones, and the old and new ones were made from one foot and a half, or nearly two feet, which has made the land too dry, and has taken away much of the spring food, so essential for sheep in March and April to keep them in condition, and to afford a supply of milk to their lambs. The stock is starved in those two months, being only half-fed, and, as a result, there is a light clip of wool, a want of lambs, and loss otherwise. The reason is, spring food for sheep in natural hill-pasture is mostly derived from plants springing from land na-

turally wet, which is the safety of sheep in lamb, in a barren spring, before the grass comes in May. In an early spring the want is not felt. The over-draining of the land, in many districts, has completely taken away that kind of food, which, I am satisfied, has greatly added to the loss of Cheviot sheep this spring, along with other causes; one of which is, of late years, the general prohibition of burning either heath or bent, which is just a part of the improvement of coarse land. By clearing off its rough coarse covering after drainage, a sweet clean herbage naturally follows for a number of years, similar to clover, upon which the sheep readily feed, and get into condition. From my observation, as well as information from intelligent and experienced farmers, whenever the burning of heath and bent has been prohibited, it has proved ruinous to the stock of sheep, by bringing on every disease to which sheep are liable upon hill-pasture. This, no doubt, has added greatly to the loss of sheep upon heath farms, which are otherwise generally considered the safest of all land, where there is a proportion of dry land, heath, bent, and bog. In every district there are some farms, neither healthy nor covered with bent, which, from situation and natural barrenness of the soil, suffer whenever the losses are general. These have suffered severely this spring (1860).

The year 1740 has been handed down by tradition as a year of great severity, owing to a long snow-storm, with frost, which resulted in a great loss of sheep; next is the year 1799, which is still remembered by some; then 1807-8, 1816, 1838, were all years of great severity—long storms in winter, followed up by barren springs; much stormier in winter in high and low farms, equally barren in spring; still there was not the loss in old sheep as there was this spring, although nearly as much in lambs. From those remarks, I am satisfied, there are other causes which may be given, besides the severity of the winter of 1859 and spring of 1860, for the great loss of sheep. In 1799 the drainage had not become general, being more limited and partial on most land. In 1816 the extent drained had been doubled on many farms, and year after year the spring food was gradually lessened; and this, no doubt, when added to the discontinuance of burning heather of late years, has occasioned the loss of sheep. In olden times there were no restrictions beyond burning after 11th April, the time fixed by the Act of Parliament. What I would recommend is, when the land is made too dry, to let the drains grow well up. Before cleaning out, allow those drains that are considered to be doing harm to grew up, but clean out the others: follow this up with careful burning of heath and bent in regular rotation, not to let it get old and withered, nor to burn too much in one year. By following these directions, I am inclined to think that a loss such as has occurred this year will scarcely occur again.

It was not the snow in winter which caused the loss, for many farms which sustained great losses had never much snow. This proves the loss must have occurred from other causes. Where land on the under-side of the drain continues from year to year in a fertile state, it is a sure proof the drain is doing good; but if it becomes dry and foggy, it is a sure proof that it is made too dry, and is doing harm, as the water which kept it in a fertile state is cut off. This will be found to be the case generally in all over-drained land, which is quite useless in a barren spring. I have carefully avoided the over-draining of hill-pasture during the long period of fifty years. I foresaw what would happen in time; and the farm of Alton, on which I reside, and also my property of Harthope and Greskin, are all drained, but not with deep drains, nor too closely cut, where the land has been moderately burned, and not too much in any one year. In the springs of 1816, and 1837, and 1860, I had little loss in old sheep, and not much in lambs, when compared to some of the neighbouring farms. I am satisfied the immunity from loss is greatly owing to my avoiding extreme draining. Indeed, it is difficult to mention any improvement in land which might not be carried too far.

I am informed by the tenants of farms who have suffered severely this spring in the loss of sheep, that they have not more than one-third of the usual number of lambs; and also that, for a number of years past, they have neither the number of lambs nor the quality; and they are of opinion the land has been made too dry with deep draining, which has only become so general of late years; and this spring these deep drains added greatly to the loss, by the sheep, which were in a weak state, getting into them; and in every case ewe and lamb perished. In a district of country in Selkirk and Roxburghshires there are large tracts of land requiring draining, and having a soil not naturally fertile, producing coarse benty grasses. When that kind of soil is made too dry, sheep will never eat it bare, and it gets into a rough and coarse state, which is of some use to sheep in summer, but little in winter, and entirely lost to sheep in a barren spring. The thick covering of withered bent prevents the sheep getting to any finer and palatable grasses. It is upon such farms that the greatest loss has taken place. If that land had been still left with part or more of its natural moisture, there would have been more spring food for sheep in March and April of 1860. This, in all human probability, would have prevented such a heavy loss as has occurred upon that kind of land, at one time considered the best of Scotland's hill-pasture.

As a *postscript*, I may mention that I sent in a report to the Highland Society in 1841 upon the best way of improving barren waste-land for permanent pasture upon sheep-farms. I have lived to see the results of the system then advocated, and I

can say it has quite exceeded my sanguine expectations. It still continues to bear excellent grass, without any further expense, and has greatly improved my sheep stock on Harthope. I can with confidence recommend the plan, under similar conditions, with confidence of success.

PREMIUMS AWARDED BY THE SOCIETY IN 1860.

REPORTS.

1. The gold medal to Jas. B. Bird, Fishwick, Berwickshire, for a Report on the Comparative Fattening Qualities of Pure and Crossbred Sheep.
2. The gold medal to William Tait Burton of Toxside, Fushie Bridge, for Improvements Effected on the Estate of Toxside.
3. The gold medal to the Rev. James Duncan, Old Manse, Denholm, Hawick, for a Report on an Arboretum at Minto.
4. The gold medal to James M'Gillivray, V.S., Bonnytown, Rayne, Aberdeenshire, for a Report on Blackleg in Cattle and Sheep.
5. The gold medal to George Poyser, V.S., Ashbourne, Derbyshire, for a Report on Red-Water in Cattle.
6. The medium gold medal to Lawrence Anderson, Chapel, Moffat, for a Report on the Reclamation of Waste Land on Sheep-Ranges.
7. The medium gold medal to Hugh Borthwick, shepherd, Traquair Knowes, Peebles, for a Report on the Diseases of Sheep fed on Turnips.
8. The medium gold medal to Hugh Borthwick, Traquair Knowes, Peebles, for a Report on the Drainage of Sheep Farms.
9. The medium gold medal to James Forbes, gardener, Monymusk House, Aberdeenshire, for a Report on the Cultivation of Willows.
10. The medium gold medal to James Forbes, gardener, Monymusk House, Aberdeenshire, for a Report on the Management of Hedges.
11. The medium gold medal to Andrew Tait, land-steward to the Right Hon. Sir George Clerk of Penicuik, Bart., for a Report on the Management of Hedges.
12. The medium gold medal to P. R. Latham, Abercalder, Fort Augustus, for a Report on the Drainage of Sheep Farms.
13. The medium gold medal to Archibald Sutter, C.E., Edinburgh, for a Report on the Main Drainage of an Agricultural District.
14. The medium gold medal to Archibald Sutter, C.E., Edinburgh, for a Report on Embankments in Holland.
15. The medium gold medal to Henry Tanner, Professor of Rural Economy, Queen's College, Birmingham, for a Report on the Relative Value of Cultivation and Manure as Sources of Fertility.
16. The silver medal to William Walker, Ardhuncart, Kildrummie, Aberdeenshire, for a Report of Experiments with Different Varieties of Oats.
17. The silver medal to Peter Johnston, Alton, Moffat, for a Report on the Loss of Sheep in Spring 1860.

DISTRICT COMPETITIONS.

CATTLE.

The Middle Ward of Lanarkshire.

BULLS.		Tudhope and Tod, Strathaven, .	Silver Medal.		
BULLS, Class I.*	1.	Robert Hastie, Brackenridge, Strathaven,	L.8	0	0
„ „	2.	William Dickie, Rutheran, Chapelton,	4	0	0
BULLS, Class II.†		James Stone, Ardochrig, East Kilbride,	5	0	0
HEIFERS.	1.	James Morton, Park, East Kilbride,	5	0	0
„	2.	Andrew Strang, Causeyhead, East Kilbride,	3	0	0

The County of Elgin.

BULLS, Class I.	1.	James Geddes, Orbliston, Fochabers,	L.8	0	0
„ „	2.	James Mitchell, Burnside, Fochabers,	4	0	0
BULLS, Class II.		John M'Kessack, Balnaferry, Forres,	5	0	0
HEIFERS.	1.	James Geddes, Orbliston, Fochabers,	5	0	0
„	2.	William Stephen, Inchbroom, Elgin, .	3	0	0

The County of Fife.

BULLS.		Lord Kinnaird, Rossie Priory, .	Silver Medal.		
BULLS, Class I.	1.	Alexander Reid, Crurie, Cupar Fife,	L.8	0	0
„ „	2.	Jas. Gulland, Newton of Wemyss, Kirkcaldy,	4	0	0
BULLS, Class II.		John Rintoul, Overston, Pittenweem,	5	0	0
HEIFERS.	1.	George Brown, Balgarvie, Cupar-Fife,	2	10	0‡
„	2.	A. and A. Mitchell, Alloa Mills, Alloa,	1	10	0‡

The District of Spey, Avon, and Fiddochside.

BULLS.		Sir George Macpherson Grant, Bart.,	Silver Medal.		
BULLS, Class I.	1.	Wm. Robertson, Burnside, Ballindalloch,	L.4	0	0‡
„ „	2.	James Grant, Clashnoir, Ballindalloch,	2	0	0
BULLS, Class II.		Alexander Paterson, Mulben, Keith,	5	0	0
HEIFERS.	1.	Alexander Paterson, Mulben, Keith,	5	0	0
„	2.	Alexander Paterson, Mulben, Keith,	3	0	0

The District of Kelso.

BULLS, Class I.	1.	William Tod, Elphinstone Tower, .	L.8	0	0
„ „	2.	William Tod, Elphinstone Tower, .	4	0	0
BULLS, Class II.		Andrew Haddon, Honeyburn, Hawick,	5	0	0

The County of Clackmannan.

BULLS, Class II.		James Snowdone, Beechwood, Tillicoultry,	L.5	0	0
HEIFERS.	1.	A. and A. Mitchell, Alloa, . .	2	10	0‡
„	2.	A. and A. Mitchell, Alloa, . .	1	10	0

The District of Auchterarder.

BULLS.		J. Gardiner, of Rottearns, Auchterarder,	Silver Medal.		
BULLS, Class II.		Alexander Rintoul, Ladywells, do.,	L.2	10	0‡

The District of Perth, Fife, and Clackmannan Association.

BULLS, Class I.	1.	John M'Laren, Monzie, Blair-Athole,	L.4	0	0‡
„ „	2.	John M'Laren, Monzie, Blair-Athole,	2	0	0‡

* Class I., Bulls calved before 1st January 1858.
† Class II., Bulls calved after 1st January 1858.
‡ Half Premiums awarded, the number of lots being under six.

The County of Peebles.

BULLS, Class I.	1. Robert Tod, Cardrona, Peebles, .	L.4	0	0	
,, ,,	2. John Gairns, Posso, Peebles, .	2	0	0	
BULLS, Class II.	Francis Scott, Howford, Peebles, .	5	0	0	
HEIFERS.	Francis Scott, Howford, Peebles, .	1	10	0*	

The District of Cowal.

BULLS, Class I.	1. James Paton, Bankhead, Partick, .	L.8	0	0
,, ,,	2. Robert Lamont, Ardyne, Innellan, .	4	0	0
BULLS, Class II.	Ninian Duncan, Coleven, Bute, .	5	0	0
HEIFERS.	1. Daniel Mercer, Auchmore, Dunoon,	5	0	0
,,	2. William Spier, Ardenstate, Dunoon,	3	0	0

The District of the Royal Northern Society.

BULLS, Class I.	1. Silvester Campbell, Kinnellar, Dyce,	L.8	0	0
,, ,,	2. Anthony Cruickshank, Sittyton, .	4	0	0
BULLS, Class II.	John Hunter, Dipple, Fochabers, .	2	10	0*
HEIFERS.	1. George Shepherd, Shethin, Tarves, .	2	10	0
,,	2. Silvester Campbell, Kinnellar, Dyce,	1	10	0*

The District of the Deeside Association.

BULLS.	Robert Walker, Hillside House, Aberdeen,	Silver Medal.		
BULLS, Class I.	1. Robert Walker, Hillside House, .	L.8	0	0
,, ,,	2. Robert Walker, Mountbletton, Banff,	4	0	0
BULLS, Class II.	William M'Combie, Tillyfour, Aberdeen,	2	10	0*
HEIFERS.	1. William M'Combie, Tillyfour, .	2	10	0*
,,	2. Robert Walker, Hillside House, .	1	10	0*

The District of Mar.

BULLS.	Messrs Fowler and Donald, Midmar,	Silver Medal.

The District of Lorn.

HEIFERS.	Duncan M'Callum, Kilmaronaig, Oban,	Silver Medal.

DRAUGHT-HORSES.

The County of Stirling.

STALLIONS.	James Turnbull, Castleton of Carnock,	L.25	0	0
MARES.	James Coubrough, Blairtummock, Campsie,	10	0	0
FILLIES.	James Easen, Inches, Falkirk, .	5	0	0

The County of Forfar.

STALLIONS.	John Dalgety, Heatherstacks, Forfar, .	L.25	0	0
MARES.	Alexander Kydd, Balmirnner, Arbroath,	10	0	0
FILLIES.	The Earl of Southesk, Kinnaird Castle,	5	0	0

The Island of Bute.

STALLIONS.	John Barr, Barrangry, Bishopton, .	L.25	0	0
MARES.	William Crawford, Acholter, Rothesay,	10	0	0
FILLIES.	John Somerville, Bannantyne Mains, do.,	5	0	0

* Half Premiums awarded, the number of lots being under six.

The County of Caithness.

STALLIONS.	Archibald K. Leitch, Inchstellie, Forres,	L.25 0 0
MARES.	Sir George Dunbar, Bart., Ackergill Tower,	10 0 0
FILLIES.	Alexander Henderson, of Stemster, Thurso,	5 0 0

The County of Kincardine.

STALLIONS.	Robert Lyall, Carcary, Brechin, .	L.25 0 0
MARES.	William Johnston, Mill of Kincardine,	10 0 0
FILLIES.	John Jolly, Banff, Fordoun. . .	5 0 0

COLTS.

The District of Kintyre.

TWO-YEAR OLD COLTS.	James Dunlop, Ballyshear, .	L.6 0 0
ONE-YEAR-OLD COLTS.	James Smith, Rhoin, . .	4 0 0

LEICESTER SHEEP.

The County of Ayr.

TUPS.	Adam Rankine of Knockdow, Maybole,	L.2 10 0*

The County of Forfar.

TUPS.	William Smith, Westhall, Dundee, .	Silver Medal.
TUPS.	D. Smith, Mains of Dunnichen, Dundee,	L.2 10 0*
SHEARLING TUPS.	William Ruxton, Farnell, Brechin, .	5 0 0
EWES.	S. T. M. Hood, Pitcur, Coupar-Angus,	2 10 0*
SHEARLING EWES.	S. T. M. Hood, Pitcur, Coupar-Angus, .	4 0 0

The District of the Perth, Fife, and Clackmannan Association.

TUPS.	Lord Kinnaird, Rossie Priory, . .	Silver Medal.
TUPS.	David Wallace, Balgrummo, Leven, .	L.5 0 0
SHEARLING TUPS.	David Wallace, Balgrummo, Leven, .	5 0 0
EWES.	A. Hill, Stonywynd, St Andrews, .	5 0 0
SHEARLING EWES.	David Wallace, Balgrummo, Leven, .	4 0 0

The County of Haddington.

TUPS.	Sir Thomas Buchan Hepburn, Bart., .	Silver Medal.
TUPS.	Thomas Simson, Blainslie, Lauder, .	L.5 0 0
SHEARLING TUPS.	Thomas Watson, Esperston, Gorebridge,	5 0 0
EWES.	George Hope, Fenton Barns, Drem, .	2 10 0*
SHEARLING EWES.	J. Stevenson, Halls, Prestonkirk, .	2 0 0*

CHEVIOT SHEEP.

The County of Selkirk.

TUPS.	Walter Elliot, Overkirkhope, Selkirk, .	L.5 0 0
SHEARLING TUPS.	Gideon Scott, Singlee, Selkirk, .	2 10 0*
EWES.	Thomas Mitchell, Kirkhope, Selkirk, .	2 10 0*
SHEARLING EWES.	Thomas Elliot, Blackhall, Galashiels, .	2 0 0*

Islay, Jura, and Colonsay.

TUPS.	Wm. M'Ewan, Sunderland, . .	Silver Medal.
TUPS.	Colin Hay, Columkill, Port-Ellen, .	L.5 0 0
SHEARLING TUPS.	Charles M'Neill, Lossit, Ballygrant, .	2 10 0*
EWES.	Peter Carmichael, Balleymoney, Bowmore,	2 10 0*
SHEARLING EWES.	Peter Carmichael, Balleymoney, Bowmore,	2 0 0*

* Half Premiums awarded, the number of lots being under six.

BLACKFACED SHEEP.

The District of Athole.

TUPS.	Robert Elliot, Laighwood, Dunkeld, .	L.5	0	0
SHEARLING TUPS.	Robert Elliot, Laighwood, Dunkeld, .	5	0	0
EWES.	John M'Laren, Monzie, Blair-Athole, .	2	10	0*
SHEARLING EWES.	John M'Laren, Monzie, Blair-Athole, .	2	0	0*

The District of Breadalbane and Weem.

TUPS.	John Robertson, Glenlyon House, Fortingall,	L.5	0	0
SHEARLING TUPS.	John and Jas. Campbell, Boreland, Kenmore,	5	0	0
EWES.	John Willison, Kenknock, Glenlochy, Killin,	5	0	0
SHEARLING EWES.	Donald M'Gregor and John Robertson, Tomochoarn, Fortingall, ...	4	0	0

The County of Dumbarton.

TUPS.	William Turner, Gavinburn, Old Kilpatrick, Silver Medal.			
TUPS.	William Turner, Gavinburn, Old Kilpatrick,	L.2	10	0*
SHEARLING TUPS.	William Turner, Gavinburn, Old Kilpatrick,	2	10	0*
EWES.	William Turner, Gavinburn, Old Kilpatrick,	2	10	0*
SHEARLING EWES.	William Turner, Gavinburn, Old Kilpatrick,	2	0	0*

The Districts of Badenoch and Rothiemurchus.

TUPS.	Alex. Macdonald, jr., Strathmashie, .	L.2	10	0*
SHEARLING TUPS.	J. Stewart, Biallid, Kingussie, . .	2	10	0*
EWES.	J. Stewart, Biallid, Kingussie, . .	2	10	0*
SHEARLING EWES.	Alex. Macdonald, jr., Strathmashie, Kingussie,	2	0	0*

The Districts of Mull and Morven.

SHEARLING TUPS. James D. Macalister, Ardnacross, Tobermory, Silver Medal.

SHEEP-SHEARING.

The Silver Medal was awarded to Alexander Dick, overseer, Gadgirth, at a competition held at Ayr on the 24th of April last.

SWINE.

The County of Renfrew.

BOARS.	1. Alexander Carswell, Barrhead, . .	L.2	0	0*
	2. Robert Carswell, Barrhead, . .	1	0	0*
SOWS.	1. John Mackay, Barrhead, . . .	3	0	0

The County of Edinburgh.

BOARS.	1. James Wilson, Wester Cowden, Dalkeith,	L.2	0	0*
	2. James Wilson, Wester Cowden, Dalkeith,	1	0	0*
SOWS.	1. W. H. Brown of Ashley, Ratho, .	3	0	0
	2. Thomas Sadler, Norton Mains, Ratho, .	1	0	0

DAIRY PRODUCE.

The District of the Forbes and Fordyce Society.

CURED BUTTER.	1. Mrs Penny, Scelmanae, Tyrie, . .	L.3	0	0
Do.	2. Miss Forrest, Ladysford, Tyrie, . .	2	0	0
SWEET-MILK CHEESE.	1. Mrs Whyte, Pinkerston, Tyrie, . .	3	0	0
	2. Mrs Pittendrigh, Newseat, Tyrie, .	2	0	0

* Half premiums awarded, the number of lots being under six.

The County of Ayr.

CURED BUTTER.	Frederick J. Turner, the Dean, Kilmarnock,	Silver Medal.
Do.	1. John Whyte, Dykescroft, Kilmarnock, .	L.3 0 0
Do.	2. Gavin Muir, Fingart, Dunlop, . .	2 0 0
SWEET-MILK CHEESE.	1. Alexander Pollock, Muirhead, Galston, .	3 0 0
	2. William Arthur, Wellhill, New Cumnock,	2 0 0

The District in connection with the Glasgow Society.

CURED BUTTER.	1. Alex Graham, Summerston, East Kilpatrick, ...	L.3 0 0
Do.	2. John Tannahill, Kirkhill, Mearns, .	2 0 0
SWEET-MILK CHEESE.	1. Allan Gilmour, Broom, Stewarton, .	3 0 0
	2. James Wilson, Old Mill, New Cumnock,	2 0 0

The District of Kintyre.

CURED BUTTER.	1. James M'Nair, Smerly, Campbeltown,	L.3 0 0
Do.	2. James Smith, Machrehanish, Campbeltown,	2 0 0
SWEET-MILK CHEESE.	1. John Sommerville, Belloch, Campbeltown,	3 0 0
	2. Robert Hunter, Lephenstrath, Campbeltown,	2 0 0

SEEDS.

The Silver Medal has been awarded to each of the following parties:—

The County of Inverness.

1. Evan Logan, Stoneyfield, Inverness, for White Wheat.
2. D. C. Cameron, Kerrowaird, Petty, for Chevalier Barley.

The County of Nairn.

1. Alexander M'Arthur, Boghole, Forres, for Chevalier Barley.
2. Alexander Robertson, Golford, Nairn, for Grey Angus Oats.
3. David Mackintosh, Urchany, Nairn, for Perennial Rye-Grass Seed.

The County of Fife.

1. James L. Millar, Waulk Mill, Dunfermline, for Australian Wheat.
2. A. W. Russell, Parkhill, Newburgh, for Wheat *(Jackson's Nonsuch).*

The County of Wigtown.

1. Hugh Hannay, Culgroat, Stranraer, for White Essex Wheat.
2. Hugh Hannay, Culgroat, Stranraer, for Potato Oats.
3. Alex. H. M'Clean, Auchneel, Stranraer, for Perennial Rye-Grass Seed.

The County of Stirling.

1. Thomas Murdoch, Westwood, Blairdrummond, for Wheat *(M'Ewan's Prizetaker).*
2. John Blair, Clayhills of Touchadam, Stirling, for Common Barley.
3. Thos. Murdoch, Westwood, Blairdrummond, for Early Blainslie Oats.
4. William Carrick, Baad, Blairdrummond, for Scotch Beans.

The County of Ayr.

1. Robert Montgomerie, Cockhill, Dundonald, for Chevalier Barley.
2. Robert Montgomerie, Cockhill, Dundonald, for Long Oats.
3. James Wright, Kilnford, Dundonald, for Long Essex Wheat.

GREEN CROPS ON SMALL POSSESSIONS.

The Parishes of Kenmore and Killin.

1.	Donald and Archibald M'Dougall, Miltown, . . .	L.3 0 0
2.	John Cameron, Easter Kenknock, ...	2 10 0
3.	Donald M'Diarmid, Shenlarich, ...	1 10 0
4.	Peter Crerar, Croftintygan, ...	1 0 0

PLOUGHING COMPETITIONS.

In the course of the year the Society's Medal was awarded at 118 Ploughing Competitions.

MANAGEMENT OF REAPING MACHINES.

Inchture.

A. Reid, St Martins, Perth, ... Silver Medal.

Clifton—Mid-Calder.

Andrew Watson, Clifton, Mid-Calder, ... Silver Medal.

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Silver Medal has been awarded to the following parties :—

Western District of Mid-Lothian Association.

Andrew Morton, Biccarton, Whitburn, for an Ayrshire Bull.

District of the Forbes and Fordyce Association.

Samuel Stewart, Sandhole, Fraserburgh, for a Short-horn Bull.

The District of Buchan.

George Baird, of Strichen, for a Polled Angus Bull.

The District of Breadalbane and Weem.

John Robertson, Glenlyon House, Fortingall, for a West Highland Bull.
John M'Pherson, Kenmore, for best-managed Green Crop.
John Cameron, Easter Kenknock, for best-kept Dunghill.

The Bute Farmers' Society.

William Johnston, West St Colmac, for best managed Green Crop.

Clackmannanshire Society.

John M'Nellan, jr., Solsgirth, for best-managed Green Crop (Dryfield).
A. & A. Mitchell, Inch, Alloa, for best-managed Green Crop (Kerse).
William Menzies, Kincardine, for best-made Hay.

Mauchline Society.

Bryce Nairn, High Wellington, Mauchline, for best-managed Dairy.

COTTAGES AND GARDENS.

FOR THE BEST-KEPT COTTAGES AND GARDENS.

First Cottage Premium—L.1, 5s., and Medal when Four Competitors; Second—L.1; Third—15s. First Garden Premium—L.1, 5s., and Medal when Four Competitors; Second—L.1; Third, 15s.

FORGUE.—1st, Cottage Premium and Medal to Mrs Smith; 2d, to James Munro; 3d, to James Riddock. 1st Garden Premium and Medal to John Greig; 2d, to James Wilson; 3d, to Peter George.

Leochel Cushnie.—1st Cottage Premium and Medal to Francis Lawson; 2d, to William Williams; 3d, to John Emslie. 1st Garden Premium and Medal to Charles Murray; 2d, to George Hendry; 3d, to Joseph Durward.

Falkland.—1st Garden Premium and Medal to Frederick Wilkie; 2d, to Alexander Walker; 3d, to James Anderson.

Newburgh and Abdie.—1st Cottage Premium and Medal to Andrew Clunie; 2d, to James Barclay; 3d, to George Bett.

Covington.—1st Cottage Premium and Medal to James Wood; 2d, to John Balloch; 3d, to Adam Henderson. 1st Garden Premium and Medal to Adam Henderson; 2d, to Thomas Porteous; 3d, to James Wood.

St Martins.—1st Cottage Premium and Medal to William Herd; 2d, to John Watson; 3d, to William Butter. 1st Garden Premium and Medal to Richard Fotheringham; 2d, to William Herd; 3d, to John Kinnear.

MEDALS GIVEN IN AID OF PRIVATE COMPETITIONS.

Newburgh Society.

James Gardiner, Carpow, for best-kept Cottage and Garden.

Conan Society.

Thomas Mackenzie, Conan, for best-kept Cottage and Garden.

Mauchline Society.

Forester Muir, Mauchline, for best-kept Cottage Garden.

VETERINARY COLLEGE.

Silver Medals were awarded, at the annual examination in April last, to the following parties:—

1. Richard Rutherford, Edinburgh, for best general examination.
2. Henry Thompson, Cumberland, for best examination in Anatomy and Physiology.
3. Andrew Smith, Ayrshire, for best examination in Anatomy and Physiology, *Junior Divison.*
4. John Burbage, Manchester, for best Anatomical Preparation.
5. Richard Rutherford, Edinburgh, for best examination in Horse Pathology.
6. Godfrey Smith, Yorkshire, for best examination in Cattle Pathology.
7. S. J. Wills, Exminster, Devon, for best examination in Cattle Pathology, *Junior Division.*

All Premiums not applied for within two years from the 1st of January last will be forfeited.

By order of the Directors,

Jn. Hall Maxwell, *Secretary.*

Edinburgh, 11*th February* 1861.

THE SUPPOSED EXHAUSTION OF THE SOIL BY THE MODERN SYSTEM OF AGRICULTURE.

By Professor Anderson, Chemist to the Society.

When the progress of any art is examined, and the successive steps by which the improvement of its practice is accomplished are carefully traced, its development is seldom found to be the simple and peaceful occupation of our fields. It most generally involves, not merely a succession of conquests gained with greater or less difficulty, but a constant and watchful struggle to maintain the vantage-ground which has been attained. Every difficulty which has been overcome carries new difficulties in its train, opens up new problems to be examined, and entails the more minute study of facts and phenomena, which in a less advanced state of knowledge may have appeared of little moment, but which acquire increased importance as a means of fortifying us in the position we have gained.

All this is very forcibly illustrated in the practice of agriculture in which we may be said to maintain a constant struggle with nature, for we seek to obtain from the soil an amount of produce greater than it yields in its natural state · and when it has been brought into a condition in which this result is obtained, there is a constant tendency to revert to its original state, which must be resisted by artificial means; and this object is arrived at, not by forcing nature, or attempting to run counter to the fixed and immutable laws by which the universe is governed, but by studying the principles on which their action depends, and thus learning how to modify the conditions under which they operate, so as to suit the ends we have in view. It is only in the later stages of agriculture, however, that this phase in its progress is arrived at, a great part of our practical knowledge being, in the first instance, acquired by purely empirical observations; and it is astonishing how much information can be, and has been, thus accumulated at a very early period; but there is a limit which cannot thus be passed, and after it has been reached, although the art may not stand still, its progress becomes exceedingly slow. Judging from the writings of the classical authors on agriculture, it would appear that the husbandmen of ancient Rome, nearly two thousand years ago, were well acquainted with all the important operations of agriculture, and their practice appears to have been little inferior to that in use throughout Europe seventy or eighty years since. In some respects, indeed, they were in advance of that period, for their manure-heaps were carefully attended to, and they drained their land; as a proof of which, it may be stated that the instructions given by Columella for making a covered drain with stones, might be transferred almost unaltered to any modern work on agriculture.

The reason why agriculture advanced so slowly after the time of the Romans, is due to the fact that they had nearly reached the limit which could be attained by mere empirical trials. They had learned almost all that can be easily and quickly acquired in this way, and advanced to the point at which it became a very slow, laborious, and costly method of adding to our knowledge, and whence further progress can only be made by studying the cause of the phenomena with which we meet. Agriculture, therefore, stagnated for want of an explanation of the facts which had been observed; and we find that the commencement of its recent rapid progress was simultaneous with the development of those wonders of science which afford these explanations. So soon as we began to understand that the mechanical treatment of the soil acted by admitting the atmospheric oxygen to disintegrate it, and liberate its useful elements, a new stimulus was given to the contrivance of machinery by which these operations might be more effectually accomplished; and when it was further ascertained that a manure acted by supplying those substances which are indispensable to the plant and form its food, and when their nature had been explained, we were enabled to use many substances which empirical agriculture would never have employed; and the word manure, which was formerly synonymous with dung, acquired a new and much more extended signification. Up to a comparatively recent period, the views which were entertained, both by agriculturists and chemists, regarding the nature of the food of plants, were very indefinite and erroneous. It was universally supposed that their main nutriment consisted of the humus of the soil, which was believed to be directly absorbed and assimilated by the plant; and that their inorganic constituents were unimportant and altogether fortuitous, and existed in them only because they happened to be absorbed along with the humus. It is scarcely necessary to observe that this opinion is now no longer maintained, incontrovertible experiments having shown that plants can grow and reach maturity where they have been entirely deprived of humus, but that they cannot exist without an adequate supply of inorganic matters, ammonia, carbonic acid, and water. As the substances which the plant specially requires form a very minute fraction of the weight of the soil, the establishment of these facts has directed attention very prominently to the possibility of exhausting the supply of them; and the question has been raised whether the system of cultivation now in use is calculated to prevent this exhaustion, or whether it may not ultimately impoverish the soil.

It is quite clear that this is a question of the most vital importance to the country at large; for if it can be shown that we are gradully reducing the fertility, the sooner a change is introduced the better. It may no doubt be alleged, that to the farmer all this is a matter of no interest, because his connection with the soil is a terminable one, and his object is to obtain from it as much produce

as he possibly can, irrespective of those who are to come after him. And it has been maintained that modern agriculture is actually founded on this principle ; and that while we pride ourselves on the increased produce which we now obtain from the soil, we have forgotten that it is produced at the expense of a future diminution of the crops, although sooner or later this fact will inevitably be brought home to us. Modern agriculture, in fact, has been described as a system of spoliation, and the necessity for an immediate change has been very strongly urged upon us.

It is my intention on the present occasion to consider how far these views are founded on fact; and the subject is one not unattended with difficulties, for it must be discussed in a broad spirit, and viewed, not in relation to a single field or farm, but to the general effect over the whole country.

In order that we may have definite data to go upon, let us in the first instance consider the cause of the exhaustion of a soil, and the different modes in which it may be brought about. It is to be observed, then, that all plants require for their growth an adequate supply of carbonic acid, ammonia, nitric acid, water, potash, soda, lime, magnesia, phosphoric acid, sulphuric acid, chlorine, and silicas, which are all indispensable, although some of them are required in larger quantities than others. They are divisible into two classes, one including the first four substances, which, being all either gaseous or volatile, are found not only in the soil but in the atmosphere; the remainder are confined, at least in quantity to the soil. These two great classes are usually distinguished as the organic and inorganic elements of the plant-food, by which it is to be understood that the former, though they are in a chemical sense inorganic, are the source of the organic or combustible part of the plant, while the latter supply the constituents of the ash. They may also, however, and with more advantage, be described as the movable and the immovable elements of the plant; because the former, existing in the air, are conveyed backwards and forwards by the wind, while the latter, being fixed in the soil, cannot be removed and replaced by ordinary natural causes. It is sufficiently obvious that if a crop be grown for a succession of years, and be systematically removed from the soil, the quantity of these substances must be gradually diminished, and, if this course be persisted in, the soil must eventually become incapable of supporting the life of plants. The period at which this will occur must necessarily differ very greatly in different soils, and depend on the quantity of available plant-food which they contain. It is to be observed, also, that the exhaustion of the soil in such a case is not due to the deprivation of all the elements of plant-food, for the air, constantly shifting, is always prepared to yield a practically inexhaustible supply of the movable elements, so that the exhaustion must in all cases be due to the removal of the fixed or mineral substances; and, consequently, when it is wished

to restore to the soil its power of supporting vegetation, it is not *necessary* to add to it all the elements of the plant, but it will suffice to give those which it cannot otherwise obtain—that is, the fixed substances—and leave it to depend entirely on the air for a supply of those which can be derived from it. We do not mean to discuss here the question whether this method would reproduce the highest degree of fertility, but only to point out that a soil thus treated would regain more or less completely the power of supporting plant-life, of which it would have been deprived by the supposed system of management.

In point of fact, then, the complete exhaustion of a soil in its natural state must always be due to the want of mineral matters, because, practically, no method of treatment can deprive it of those which the air supplies. As far, also, as these matters are concerned, it must be obvious that they would rarely, if ever, be all exhausted simultaneously, but that, in general, some one substance being present in relatively small proportion, the soil becomes incapable of supporting the life of plants when it is entirely withdrawn, although there may still be an abundant supply of all the others. If, for example, a soil contain a sufficient quantity of potash to yield, say, twenty full crops of wheat, and of the other constituents of that plant enough to yield forty crops, the excess of the latter will be unavailing, and the soil would be exhausted by twenty crops. If now we added to such a soil a supply of potash, it would again become capable of producing a crop, and would go on doing so until some other substance had been entirely consumed, when it also would have to be added; and so on until, all being removed, the soil would at length end in a complete infertility, which would only be retarded, and not prevented, by this mode of operation. To maintain during an unlimited series of years a uniform amount of produce, it would be necessary to add, year by year, a quantity of the elements of plant-food equal to that which the crop removes; and the necessity for doing this is so obvious that it cannot be controverted, and it may be safely asserted that it is a point on which all scientific and practical men are entirely at one.

This being the principle on which the exhaustion of the soil is to be avoided, we have only to carry it out a little further to draw the conclusion, that if we add to it a larger quantity of the elements of plant-food than is requisite to replace what has been removed, its productive capacity must be increased, and it will become capable of yielding a larger crop than it did in its original state. This is in fact the foundation of the use of manures, and if it were possible to carry out these theoretical principles in their integrity, the soil might be made to produce, during an unlimited succession of years, a crop greatly exceeding anything known in actual practice. Practically, however, there is a limit which cannot be exceeded, and this depends upon several circumstances. In the first place, the effect

of a manure is not due to its composition alone, but is dependent, to no small extent, upon the different constituents existing in it in a state in which they are readily available to the plant. And in the second place, the composition of manures is not entirely under our control. Although farmyard manure, which is, and will always continue to be, the foundation of agricultural practice, is a mixture containing all the elements of plant-food, and generally in proportions not very far removed from those in which the plant requires them, yet it is impossible not to recognise the fact that differences occur in it, and that part of its constituents are not directly available to the plant, but only become so by virtue of certain changes which occur in it after it has been deposited in the soil, and do not necessarily proceed exactly as we could desire. It is a familiar fact that, owing to these decompositions proceeding in an imperfect manner, manure may, and often does, accumulate in the soil, and remains there in an inert and dormant condition. If from this or any other circumstance the supply of one or more of the substances required by the plant is deficient in the manure, then either the crop is thereby limited, or it is forced to derive the requisite supply of that substance from the natural resources of the soil itself. In fact, a manure which is deficient in any one element of the crop, does not improve the soil; and though it may produce a greatly increased crop, its effect is merely temporary, and eventually it only causes its more rapid exhaustion. In the case of farmyard manure, which necessarily contains all the elements of plants, this is, of course, less likely to occur than in special manures containing only one or two of these substances. Thus, for example, the opposite effect would be conspicuously seen in the case of a soil manured during a series of years with a salt of ammonia. In that case, though the crop might be greatly increased in any one year, the total amount of produce would be no larger than it would have been without that addition, but it would have been obtained within a shorter period of time.

The general conclusion to which all these considerations lead is, that we can only maintain the fertility of the soil by returning to it all the substances which the crop removes, and that we can increase it by applying these in larger quantity; but when the mixture supplied is deficient in any one substance, it does not prevent but hastens exhaustion.

It was formerly believed that another great source of the deterioration of the soil was to be found in the removal from it of the valuable matters in the drainage-water. But our increased knowledge of the properties of the soil, its power of withdrawing the most important constituents of plants from their watery solution, and the composition of the drainage-water, have shown that any loss accruing in this way is so small as to be quite unimportant. It appears from the analyses of drainage-water, and from knowing the

quantity which passes off by the drains in the course of a year, that the maximum amount of potash thus removed does not exceed two or three pounds to the acre, and is often much less, and the quantity of ammonia is usually under a pound. On highly-manured lands there is sometimes a considerable loss of nitrogen in the form of nitric acid, but on ordinary soils this also appears to be inconsiderable. When it is borne in mind that one per cent of potash amounts on the acre of land to at least ten tons, it will be seen that the loss of two or three pounds does not merit notice, for it must be a very poor soil which does not contain from a quarter to a half per cent of any of the constituents of plants.

So far, then, from there being any loss of those valuable matters which the plant requires, there is a conservative influence constantly at work, by which they are safely stored in the soil, and preserved for the use of the crop; and when its exhaustion takes place, it is never due to natural causes, but may be safely attributed to the injudicious method of cultivation to which it has been subjected.

It is admitted that the acreable produce of this country has increased, though not perhaps to the extent which is commonly believed by the non-agricultural public; and it is alleged that this is due to drainage, which is understood to have added nearly a quarter of grain to the produce, and to the use of artificial manures, such as guano and bones, which do not contain all the elements of plants, but only ammonia and phosphoric acid, and thus it would appear that we have abandoned the very principles which science lays down for our guidance, and in place of restoring all the elements of fertility, we are using only those which encourage the crop to draw more largely than it would otherwise do on the productive resources of the soil In short, that we have begun to live on capital in place of interest, and are bringing about, although more slowly, the state of things which has been observed in America; and it is argued that, if this occurs on the rich virgin soils of that country, we must expect the same to occur on the poor soils of the British Islands. Although it does not bear absolutely on the point at issue, it may be observed here that the case of these soils has been greatly overstated. A virgin soil, as it is called, is not necessarily rich; and experience has shown that the ordinary soils of America do not surpass those of European countries. But when originally settled, the greater part of the land suited for agriculture had lain for ages under forests which had to be cleared before it could be brought under cultivation. Now land which has been long in forest is very far from being in its natural state, but must be looked upon as being highly manured. Trees send their roots deep into the soil in search of nutriment, and gather from the air a large amount of carbonic acid and ammonia. The greater part of the carbon is deposited in the form of woody

fibre, but, by a wise provision of nature, the other elements are chiefly accumulated in the leaves, which, by their annual fall, gradually enrich the surface soil. The quantity of matters thus accumulated in the superficial layer of the soil is equivalent to an enormous manuring, but is not sufficient to maintain the growth of plants for a long period; and hence such a soil is soon reduced to its natural state, which may be one of comparative infertility, because it is sufficiently familiar that forest trees will flourish and find all the nutriment they require when agricultural crops cannot exist. In point of fact, many of these virgin soils are naturally very poor, and their exhaustion was merely the return to their original poverty.

Of course this does not invalidate the original position, that modern agriculture has adopted an injudicious and unphilosophical system of cropping; and the question still remains, whether the method of managing the soil is such that it may be fairly thus characterised? The whole matter at issue, however, must not be taken up as a question of this or that manure, but resolves itself into ascertaining whether, throughout the whole country, there is a proper balance between the crops removed from the soil and the manures returned to it; and if it shall appear that the former so greatly exceeds the latter as to throw a larger proportion of the crop upon the natural productive capacity of the soil, there is but one conclusion to be drawn from it.

To ascertain this it is necessary to determine the quantity of valuable matters removed from the soil by the different crops, and this is a point easily arrived at by a knowledge of their composition, and of the average produce. The former has been established by numerous analyses, and for the latter, recourse must be had to agricultural statistics; and in this we fortunately possess those inquiries which were carried out some years since under the auspices of the Society. It is worthy of notice that these statistics show that the produce was formerly much overrated; and I have heard it alleged that they are still above the truth. It is probable that the error is not large; but it is well to know that it is in the direction of excess. Starting from these statistical inquiries, and when no estimate is given, as is the case in regard to the production of straw, I have calculated a table which gives a useful statement of these quantities:—

	Produce per Imperial Acre	Total Weight in lb	Total Mineral Matters	Potash	Soda	Lime	Magnesia	Chlorine	Sulphuric Acid	Phosphoric Acid	Silica.	Nitrogen
Wheat—												
Grain, . . .	28 bush. at 60 lb.	1680	34.12	10.11	1.20	1.04	4.80	...	0.32	16.22	0.43	29.20
Straw, . . .	1 ton. 3 cwt.	2576	114.48	20.70	2.84	8.53	2.23	...	3.55	3.16	73.47	16.13
Total, . .		...	148.60	30.81	4.04	9.57	7.03	...	3.87	19.38	73.90	45.33
Barley—												
Grain, . . .	33 bush. at 53 lb.	1749	44.24	9.40	0.30	0.76	3.10	1.12	0.85	15.52	13.19	34.98
Straw, . . .	18 cwt.	2016	99.14	11.24	1.14	5.81	2.75	1.30	1.10	7.22	68.58	6.03
Total, . . .		...	143.38	20.64	1.44	6.57	5 85	2.42	1.95	22.74	61.77	41.01
Oats—												
Grain, . . .	34 bush. at 40 lb.	1360	48.89	11.00	...	5.31	4.04	0.20	...	26.07	2.27	27.54
Straw, . . .	1 ton.	2240	143.53	30.71	6.10	10.29	5.50	5.55	5.18	7.35	72.85	14.10
Total, . . .		...	192.42	41.71	6.10	15.60	9.54	5.75	5.18	33.42	75.12	41.64
Beans and Peas—												
Grain, . . .	25 bush. at 60 lb.	1650	55.97	30.00	0.31	3.01	4.00	...	1.76	16.65	0.24	46.10
Straw, . . .	1 ton.	2240	108.51	48.61	13.14	29.37	3.74	7.00	2.07	0.74	3.84	26.88
Total, . . .		...	164.48	78.61	13.45	32.38	7.74	7.00	3.83	17.39	4.08	72.98
Turnips, ...	13½ tons.	30,240	213.75	57.35	44.71	28.60	4.65	10.35	39.02	22.57	6.50	60.48
Potatoes, ...	3 tons.	6720	55.58	28.92	2.85	1.20	2.11	3.21	10.24	5.76	1.29	26.00
Hay, ...	2½ tons.	5600	391.31	129.79	4.80	35.46	9.62	39.61	16.57	21.79	133.67	56.22

From this it is easy to calculate the total amounts of inorganic matters and nitrogen withdrawn in the course of any rotation ; and by way of illustration I shall select a six-course rotation, consisting of turnip, wheat, hay, oats, potatoes, and wheat, when matters stand as follows :—

	lbs.
Potash,	319.4
Soda,	66.6
Lime,	100.0
Magnesia,	39.9
Chlorine,	58.9
Sulphuric acid,	78.7
Phosphoric acid,	122.3
Silica,	364.4
Nitrogen,	274.0

Of course this must be considered a very severe rotation, and the quantity of matters removed would have been considerably reduced if a second year of grass pasture had been substituted for one of the white crops, as will often be the case. It may be noticed also, that as compared with the total quantities of the substances contained in ordinary soils, the matters removed are very small; and even if the phosphoric acid in the soil do not exceed a quarter of a per cent, it would maintain such crops for 276 years; and the same applies to the other elements, so that the prospect of exhaustion is at all events not immediate.

If now we endeavour to ascertain the quantities of the elements of plants restored to the soil in the shape of farmyard manure, we are met by the difficulty of estimating the ordinary application of that substance, and also by our still imperfect knowledge of its average composition. The number of good analyses of farmyard manure is still small, and owing to the great difficulty of obtaining a fair sample, considerable discrepancies are found in those which have been published. By selecting, however, those results which are most trustworthy, the following table has been calculated, so as to show the quantities of mineral matters and nitrogen in different quantities of the manure. Twelve tons have here been selected as an average application, and the others as quantities not unfrequently used. The entire quantities of all the different constituents are given with the exception of silica, in which case the insoluble part, consisting chiefly of sand, is omitted, as it is not of any use to the plant. The results are expressed in pounds avoirdupois—

	12 tons.	16 tons.	20 tons.
Potash,	201	268	335
Soda,	67	89	111
Lime,	337	449	561
Magnesia,	35	47	59
Chlorine,	12	16	20
Sulphuric acid,	84	112	140
Phosphoric acid,	108	144	180
Silica (soluble),	269	358	447
Nitrogen,	165	220	275

It thus appears that an application of 20 tons of farmyard manure is able to supply the elements of an ordinary rotation, some of them in just sufficient quantity, others in considerable excess. The only exception is in the case of chlorine, which is very deficient, and this is the more remarkable as it is a very abundant element in common salt; indeed it is difficult to avoid suspecting that its amount is here underrated. If 12 tons of dung be considered to be a reasonable application, then it follows that though silica, lime, soda, magnesia, and sulphuric acid are present in sufficient quantity for ordinary crops, nitrogen, potash, phosphoric acid, and chlorine are deficient. In regard to the first, however, it must be borne in mind that a very considerable quantity is derived from the air, the rain carrying down to the soil, during six years, in the form of ammonia and nitric acid, no less than 45 lb, besides that directly absorbed by the soil and the leaves. Of this latter quantity there is no means of forming an estimate; but as Boussingault has shown that dew is highly impregnated with ammonia, and as the soil can certainly withdraw that substance from the air, there can be no difficulty in admitting that an ordinary crop can easily obtain an inexhaustible supply of nitrogen. The inference to be drawn from these facts is, that, so far as farmyard manure is considered, if any exhaustion is to be feared, it must be due chiefly, if not entirely, to the loss of potash, phosphoric acid, and chlorine. The facility, however, with which the latter element can be supplied in the form of common salt, renders its deficiency in the manure of little moment; and it is the two latter which, owing to their being rare and costly, are important.

It will be observed that attention has hitherto been directed only to farmyard manure, and that no reference has been made to special manures, which now form an essential part of agricultural practice. These substances may be viewed almost exclusively as sources of nitrogen and phosphoric acid, the other elements of plants, except lime and sulphuric acid, being present in them in inconsiderable quantity. It has been already pointed out that in all probability the crops are furnished by the air and farmyard manure with sufficiency of nitrogen; but where 3 cwt. of Peruvian guano are used, they receive from that source about 45 lb. of nitrogen, which has a special value owing to its being in an immediately available state. Guanos, bones, and superphosphates, when of good quality, yield, in 3 cwt., from 50 to 100 lb. of phosphoric acid, so that when they are used along with farmyard manure, the quantity of that element added to the soil materially exceeds the requirements of the crop; and we thus come to the final conclusion that potash is the only element of which the present system of manuring does not afford an adequate supply.

The conclusions arrived at, however, by considering the subject in this way, are open to fallacy, for they are founded on data which

may be disputed. It may be maintained that the quantity of farm-yard manure, commonly applied, has been overrated, and that there must of necessity be a large annual loss of the valuable constituents of the soil, because a considerable part of the crops produced is not returned to the soil, but is carried off into the towns to be there consumed, and their elements are finally discharged through the sewers, and lost to agriculture. A gloomy picture has been drawn of the consequences of this system, especially by the supporters of the various schemes for recovering and using the valuable matters contained in town sewerage, who have spoken of it as if the whole excrementitious matters were thus lost; and by assuming the annual value of these matters at £1 for each individual, and multiplying it by the population of the town, they arrive, by a very easy method, at a very high estimate of the loss. This mode of calculation, however, is very fallacious. In the first place, it is founded on an exaggerated estimate of the value of these matters. The Chinese, who have for centuries collected them with the most scrupulous care, consider them to be worth about 2s. 3d. per head; but this is probably the opposite extreme, and probably 10s. may be considered a fair value. In the second place, it is not the case that the whole of these matters are carried off through the sewers; and though the system has greatly increased, it still withdraws much less than is commonly supposed. In Glasgow, where it has been carried further perhaps than in any other town, and where houses of £5 rent are furnished with water-closets, the whole number of these conveniences is under 10,000, which probably do not accommodate more than one-fourth of the population.

It is very difficult to form any idea of the quantity of matters really lost to agriculture through the sewers of our towns. It must be observed, however, that the part of our crops nearest to towns, and used as human food, is exactly that which contains the smallest quantities of the valuable constituents of plants. It will, probably, be a full estimate, if it be assumed that the whole grain of the cereals is thus removed; and upon this principle it appears that, in the six-course rotation already so often referred to, in which there are two wheat and an oat crop, the quantities removed are—

	lbs.
Potash,	31.2
Soda,	2.4
Lime,	7.4
Magnesia,	13.6
Chlorine,	0.2
Sulphuric acid,	0.6
Phosphoric acid,	58.5
Silica,	3.1
Nitrogen,	85.9

These numbers form a striking contrast to those obtained when we include the straw, hay, and root crops. Thus the chlorine is little more than a three-hundredth of what it is in the latter case.

The sulphuric acid and silica are about one per cent, the potash about a tenth, the nitrogen a third, and the phosphoric acid less than half of that contained in the entire crops. In these facts we see proofs of a wise provision of nature, by which the loss of the substances that must be removed is reduced to a minimum, while those requisite for the growth of the plant are accumulated in the part likely to remain.

It must not be supposed, however, that the whole of the matters thus removed are lost to agriculture. A very large proportion of the food consumed in country districts finds its way back to the soil; and this also occurs, to a certain though undoubtedly much smaller extent, in the towns. In estimating this loss, also, it must not be forgotten that a very considerable amount of the food of the population, more especially in the large towns, is imported, and has not, therefore, been removed from our fields. The average imports of grain and meal of all kinds have, for some years, averaged about 10,000,000 quarters, weighing about 1,700,000 tons, containing 34,000 tons of mineral matters, and 30,000 tons of nitrogen, and are annually more valuable than the excrementitious matters of a population of 5,000,000. The imports of the present year are far in excess of those quantities, and are said to have reached one-third of the annual requirements of the country, so that we can afford a very considerable loss without impoverishing the soil.

It has been already observed that it is by no means true that the whole of the valuable matters consumed in towns are lost. In no case does it all reach the sewers; and even in those towns in which the sewerage is most complete, a considerable quantity is collected in cesspools, or otherwise rendered available as manure. In illustration of this, reference may be made to the case of Edinburgh, although it is in some respects less favourable than other towns, because, its situation admitting of an efficient system of sewers, has encouraged their general use. I do not here refer to the use of that sewage on the irrigated meadows at Craigintinny, because that is an exceptional case, although it illustrates very forcibly that all the produce used in a town is not wasted, but to the police dung, which is collected to a large extent. This dung consists of the sweepings of the streets, the animal and vegetable refuse and ashes from the dwelling-houses, and the contents of cess-pools. At present about 48,000 tons are collected annually, and, though inferior to farmyard manure, chiefly because it does not heat, it is a valuable source of the inorganic constituents of plants. A very large quantity of a similar manure is produced in Glasgow; and though, from the system of collecting, it is impossible to ascertain its amount, I believe it may be safely estimated at 100,000 tons. In Manchester, and some other large towns, the proportion of matters restored to the soil must be still more considerable, as, by the plan there in use, by far the larger proportion of the excrementitious matters are retained.

It is clear, then, that by no means the whole of the valuable matters consumed in towns are lost; but it is equally obvious, that, when the subject is considered in this point of view, there must be a loss. It has been observed, however, that in all the great operations of nature there is always a compensating influence at work, by which a due balance is maintained. Either this occurs in the natural course of events, or the requirements of men and animals force them, often instinctively, to adopt the course necessary to bring it about. That there must be some such influence at work cannot be doubted, for we observe that in thickly peopled countries the produce shows no tendency to diminish, although they may have been cultivated for many centuries. We proceed now to inquire what these compensating influences are. And it may be observed that they are of two kinds—those relating to an individual country, and those applicable to the entire surface of the earth.

In regard to the former, it must be observed that they embrace the importation of those valuable matters in the form of food or otherwise. Reference has already been made to the imports of grain as containing an amount of these substances sufficient to counterbalance the loss occasioned by a population of 5,000,000. But, in addition to these, there are other articles of food, such as cheese, potatoes, rice, tea, coffee, &c. &c., most of which are individually small, but which, in the aggregate, amount to about 300,000 tons, and are capable of replacing the loss occasioned by nearly 800,000 human beings. Taking next the cattle-food, it appears that the average annual imports of linseed and rapecake are about 257,000 tons, which are sufficient to replace the excrementitious matters of nearly one million and a half of population. To these must also be added 84,000 tons of bones, woollen rags, and hides, of which part is used as manure, and various other substances which swell the total. It is to be observed that all those substances imported in these forms are withdrawn from the soil of other countries, and therefore are so far only counterbalancing our loss at the expense of our neighbours; but this is a result which must always occur; and there must, in the very nature of things, be a constant drain of the elements of plants from thinly-peopled to thickly-peopled countries.

But there are other compensating influences at work, which have not this drawback, and are operating over the whole surface of the globe, though still to the advantage of the thickly-populated countries. Of these, the most important is found in the substances derived from the sea. From that source there is derived the fish consumed as food, and the large quantity of offal directly available as a manure. It is impossible to form an estimate of these; but the quantity is unquestionably very large. Guano also is a substance rescued from the sea, and may be traced back to the fish which form the food of the birds which produce it. It differs, no doubt, from the other substances, already referred to, as not containing its

elements in the same proportion as plants. It yields a preponderating quantity of nitrogen and phosphates; but these, as has been already pointed out, are the substances which are withdrawn from the soil in largest proportion by the chief varieties of human food; and it is not absolutely deficient in others, the quantity annually imported containing about 2000 tons of potash. This, however, though not unimportant, is inconsiderable when compared with the other two, which amount at the very lowest estimate to 28,000 tons of nitrogen, and 35,000 of phosphoric acid. The sea also yields an abundant supply of vegetable matters which are used as manure, but no estimate of the quantity consumed can be formed; but it is exceedingly large—every farmer along the coast, who has access to the shore, using it to a large extent.

Another great source of compensation is to be found in the coal which we annually raise from our mines. We are not in the habit of looking upon it in the light of a substance of manurial value; but it must be recollected that it consists of the remains of a primeval vegetation which clothed the surface at far-distant geological periods, and that it contains, preserved in it, mineral matters which have been withdrawn from the soil, and nitrogen which existed in the form of ammonia in the atmosphere, and which is restored to it, and caused again to pass through that round of changes from which it has been shut out during the lapse of many centuries; and thus, when coal is burnt, we contribute to the general welfare of the globe, and afford to all countries a supply of that important element of plants. It is not easy to estimate the amount of ammonia annually set free in this country. Coal contains in round numbers 1 per cent of nitrogen, and, when distilled in the manufacture of gas, yields about ¼ per cent of ammonia. It is possible that, when burnt in open fires, a larger quantity passes into the form of combination; but in order to avoid over-estimating it, I shall assume only 0.2 per cent to be produced; and as the annual produce of coals in this country is 54,000,000 tons, there must be produced 128,000 tons of ammonia. It may be added that probably half as much more is produced from the coals of other countries, making an annual contribution to the air of upwards of 190,000 tons. All this, however, is not thrown into the general store—the soot which is collected in our chimneys, and which is chiefly used for agricultural purposes, containing a large quantity. The amount of ammonia thus added to the soil of this country cannot be estimated; but it is known that about 1500 tons are used as a manure in the shape of sulphate. The ash of coals is also rich in phosphoric acid, lime, and magnesia, besides containing some potash, though not a large quantity. A large quantity of the ash of coals used in furnaces is more or less completely melted, and cannot be used in agriculture; but that which is consumed in dwelling-houses mostly finds its way to new fields, and the quantity of substances thus carried to them

must be extremely large. As in coals we bring into use again the plants of distant geological epochs, so in coprolites we restore what remains to us of primæval animals, and in this shape, and that of mineral phosphates, such as agatite, about 14,000 tons of phosphoric acid are annually used. It is scarcely necessary to refer to many other sources of smaller quantities of the elements of plants, such as nitrate of soda, the salts of potash, leather, woollen rags, &c., for they are less important than those already mentioned.

It is sufficiently obvious that the matters at our disposal, for replacing any loss of the elements of our crops, is enormous. Taking only the imported grain, the oil-cakes, guano, limes, coprolites, and sulphate of ammonia, the following is a low estimate of the quantities of the three most important elements contained in them :—

	Tons.
Nitrogen, ...	75,000
Phosphoric acid, . . .	82,000
Potash, ...	14,500

It will be understood that these quantities do not include those derivable from fish-refuse, sea-weeds, soot, and a number of other sources, of which no estimate can be formed. When we look at these large supplies which are every year drawn towards our soil, it cannot be doubted that at the present moment we cannot anticipate its exhaustion ; and this conclusion is also that to which, I think, we must arrive, from all the facts of practical agriculture. It is certain that, so far as we can at present see, the soil is not becoming exhausted.

But while this is the result of all we know, I should by no means wish to lull the agriculturists of this country into fancied security, or to assert that such a result may never happen. The very facts which I have detailed show that we are at present dependent, to a very large extent, on foreign sources for the maintenance of the fertility of the soil; and though in the very nature of things the supplies of food required for our superabundant population must continue to be imported, none of the manures may become exhausted. We have already heard fears expressed that we shall, at no distant day, arrive at the end of the guano deposits, from which at present so large a proportion of the imported nitrogen and phosphates is obtained. It will not do, therefore, quietly to sit by and allow the loss in the sewage of our towns to continue; and every effort should be made to procure and return it to the soil. I confess, however, I do not expect that these efforts will be soon crowned with success, because the system of sewage is not adapted to the purpose, and is so rooted in the habits of the people that it is impossible to expect a change ; and so long as supplies of manure can be obtained so largely and cheaply as at present, we must anticipate that the loss will continue, and it will only be dire necessity which will force upon us the complete preservation of those substances which are at present lost.

INDEX.

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PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

IN

1860.

CONTENTS.

CLASS I.—REPORTS.

§ 1 On Subjects connected with the Science and Practice of Agriculture :—

PRELIMINARY NOTICE.

WHEN the HIGHLAND SOCIETY was instituted in the year 1784, and established by Royal Charter in 1787, its objects, comparatively, were few, and their operation was limited to matters connected with the amelioration of the Highlands of Scotland.

The patronage of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, or undertaken by other Associations, several of the earlier objects contemplated by the Society were consequently abandoned, while the progress of Agriculture led to the adoption of others of a more general character.

The exertions of the Society, instead of being restricted to the improvement of the Highlands, were early extended to that of the Lowlands, and have in both, for three-quarters of a century, been directed to the promotion of the science and practice of Agriculture, in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The leading purposes of the Institution are set forth in the following pages, where it will be found that Premiums are awarded for Reports on almost every subject connected with the cultivation of the soil; the rearing and feeding of stock; the management of the dairy; the growth of timber; the extension of cottage accommodation; the improvement of agricultural machinery and implements; and the dissemination of veterinary information.

Among the more important measures which have been effected by the Society, are,—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal Towns of Scotland, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A System of District Shows, instituted for the purpose of improving the Breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement and promotion of a proper system of Agricultural Education, by means of powers conferred by a Supplementary Royal Charter, authorizing "The COUNCIL of the HIGHLAND AND AGRICULTURAL SOCIETY on EDUCATION" to prescribe a curriculum of study, and to grant Diplomas to Students of Agriculture who shall pass the requisite examination (see p. 73).

4. The advancement of the Veterinary Art, by conferring the Society's diploma on Students who have passed through a prescribed curriculum, and who are found by a rigid examination qualified to practise.

5. The appointment of a Chemist for the purpose of promoting the application of science to Agriculture. Investigations on subjects of importance are conducted in the laboratory, and published in the Transactions. Members can obtain analyses, reports, and advice on terms very much below those charged to others (see p. 75).

6. The establishment of an Agricultural Museum illustrative of the vegetable products of the country.

7. Monthly Meetings during the Winter Session for the discussion of Agricultural subjects.

8. The periodical publication of the Transactions, which comprehend the proceedings in the Laboratory, Reports of Experiments, and other communications addressed to the Society. The Transactions are published by Messrs BLACKWOOD and SONS, Edinburgh, along with the Quarterly Journal of Agriculture.

CONSTITUTION AND ESTABLISHMENT.

The general business of the HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of a Royal Charter, which authorizes the enactment of Bye-Laws. Business connected with Agricultural Education is conducted under the authority of a Supplementary Royal Charter, also authorizing the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Ten Extraordinary, and Thirty Ordinary Directors, a Treasurer, an Honorary, and an Acting Secretary. The proceedings of the Directors are reported to Half-yearly General Meetings of the Society, held in January, and in June or July. The Council on Education, under the Supplementary Charter, consists of Seventeen Members—Ten nominated by the Charter, and Seven elected by the Society. The Board of Examiners consists of Thirteen Members; the first examination for the diploma will take place on the 28th and 29th March.

New Members are admitted at either of the General Meetings by Ballot. The ordinary subscription is £1, 3s. 6d. annually, which may be redeemed by one payment, varying, according to the number of previous annual payments, from £12, 12s. to £7, 1s. Tenant-Farmers, Secretaries, and Treasurers of Local Agricultural Associations, Factors, and Proprietors farming the whole of their own lands, whose assessment in the Valuation Roll does not exceed £500, are admitted on a subscription of 10s. annually, or £5, 5s. for life.

Members of the Society are entitled to apply for district Premiums,—to report Ploughing Matches for the Medal,—to attend shows, without paying,—to enter stock free,—to consult the Chemist at reduced rates,—and to receive the Journal and Transactions at a modified price.

The Premiums awarded by the Society are payable after the 1st January for the preceding year. Premiums must be applied for at the Secretary's Office, and payment can only be made on production of the stamped receipt of the party entitled to it. Premiums not applied for within two years from the term of payment will be forfeited.

All communications are to be addressed to the Secretary of the Society, 6 Albyn Place, Edinburgh.

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By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to prescribe a curriculum for Agricultural Education, and to grant Diplomas.

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The Dean of Faculty.
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The Professor of Chemistry.
The Professor of Natural History.
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Book-Keeping and Accounts—KENNETH MACKENZIE, Accountant, and PETER M'LAGAN of Pumpherston.

Museum,

GEORGE IV. BRIDGE, OPEN FREE TO THE PUBLIC.

PREMIUMS.

GENERAL REGULATIONS FOR COMPETITORS.

ALL Reports must be legibly written on only one side of the paper, and must specify the number and subject of the Premium for which they are in Competition; they must bear a distinguishing motto, and be accompanied by a sealed letter similarly distinguished, containing the name and address of the Reporter; initials must not be used.

None of the sealed letters, except those belonging to reports found entitled to at least one-half of the Premium offered, will be opened without the Author's consent.

Reports, for which a Premium, or one-half of it has been awarded become the property of the Society, and cannot be published, in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to the Author if applied for within twelve months.

When a Report is unsatisfactory, the Society is not bound to award the whole, or any part of a premium.

All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each premium must be strictly fulfilled. General Essays, and Papers compiled from books, will not be rewarded. Weights and Measurements must be indicated by the imperial standards.

The decisions of the board of Directors are final and conclusive as to all Premiums, whether offered for Reports, or at General or District Shows, and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

Reports on subjects not included in the Premium List will be received, and honorary rewards will be given, when merited.

CLASS I.

REPORTS.

SECTION 1. ON SUBJECTS CONNECTED WITH THE SCIENCE AND PRACTICE OF AGRICULTURE.

1. AGRICULTURE OF BERWICKSHIRE AND ROXBURGHSHIRE.

For an approved Report on the Agriculture of Berwickshire and Roxburghshire—Twenty-five Sovereigns.

The Report should embrace full details of the different systems of farm management observed in the district, and of the progress which Agriculture has made within the last 25 years.

Reports to be lodged by 1st November 1861.

2. DRAINAGE OF SHEEP-FARMS.

For an approved Report on the best system of draining Sheep-Farms—The Gold Medal, or Ten Sovereigns.

The Report, while based on practical observation and actual operations, must consider the general principles which should regulate the drainage of pastoral districts, the probable outlay, and the returns obtained or that may be looked for.

Reports to be lodged by 1st November 1860.

3. COTTAGES.

For an approved Report on the best construction and arrangement, and on the most suitable fittings for Labourers' Cottages in different districts, and under different circumstances—The Gold Medal, or Ten Sovereigns.

The Report must state the principles which should regulate the character of the accommodation most suitable for different districts and circumstances of the occupants. The internal fittings must be described, and the applicability and expediency of all recent improvements must be considered.

The Report must be illustrated by drawings or plans, and must embrace specifications and estimates of cost.

Reports to be lodged by 1st November 1860.

4. DEEP PLOUGHING.

For an approved Report on the comparative results obtained by the following modes of Ploughing:—*1st*, With a furrow not less than six inches; *2d*, With a furrow not less than ten inches; *3d*, By Subsoiling—The Gold Medal, or Ten Sovereigns.

The land operated on must have been thoroughly drained. The description of Plough used in each operation, and its maker's name must be given, and the value of the experiment will be enhanced were the same operation conducted with ploughs of different kinds. The Report must state the nature of the soil and subsoil, and the date, depth, and expense, of each ploughing. The extent of land to be not less than one acre for each mode of ploughing, and the produce to be weighed or measured. Except as regards ploughing, the whole land to be treated alike.

Reports to be lodged by 1st November 1860.

5. EFFECT OF SPECIAL MANURES OVER A ROTATION.

For an approved Report, to be made after a rotation, on the comparative effects, immediate and continued, of different special Manures—Thirty Sovereigns.

As the object of the premium is to encourage experiments for determining the value of various applications, as regards not only increased quantity and improved quality of crops, but also the permanence of the different substances throughout the rotation, the Report must have special reference to points such as specific gravity and quality of turnips—weights of grain, straw, and hay—effects on straw and hay for fodder—and such like. The results obtained from each application to be compared with those of the ordinary manuring of the farm. Each experiment to be conducted on not less than one rood of land, and the whole to be repeated in duplicate.

Reports to be lodged by 1st November 1860.

6. SPECIAL MANURES AS SUBSTITUTES FOR GUANO.

For an approved Report of experiments conducted with a view of determining the comparative value of other substances, mixed or unmixed, as a substitute for Guano. The experiment to embrace at least two of the manufactured or saline manures, and to be made

on turnips, grass, one or more of the cereal crops, and, if possible, on beans. Not less than half an acre to be allowed for each experiment, and the whole produce to be weighed or measured—Twenty Sovereigns.

Reports to be lodged by the 1st May 1861.

7. MANURES FOR PEAT MOSS.

For an approved Report on the best and most economical method of reclaiming and rendering productive Peat Moss,—and on the substances best adapted for fertilizing it—The Gold Medal, or Ten Sovereigns.

As it is frequently difficult to cart farm-yard manure on moss for some time after it has been drained, attention is particularly directed to the *portable* manures most efficacious in overcoming the inert properties of peat, and rendering it productive. The depth and composition of the moss experimented on—the method of improvement adopted—the quantity of lime applied, and its effects—the period of application—the nature of the drainage—the mode of constructing roads—the detailed expenditure, and the results obtained—must be stated.

Reports to be lodged by 1st November 1860.

8. MANURES PRODUCED BY DIFFERENT KINDS OF FEEDING.

For an approved Report of the result of experiments for ascertaining the comparative value of farm-yard manure, obtained from cattle fed upon different varieties of food, by the application of such manures to farm crops—Twenty Sovereigns.

The Report must state the effects produced on two successive crops by the application of manure obtained from cattle fed on different sorts of food, such as turnips and straw alone; and turnips and straw, with an addition of oil-cake, linseed, bean-meal, grain, or other substances. The animals should be as nearly as possible of the same age, weight, condition, and maturity, and each lot should receive daily the same quantity of litter; and, except as to the difference of food, they must be treated alike.

The preparation of the manure, by fermentation or otherwise, should be in every respect the same; and it is desirable that not less than two several experiments be made with each kind, and that the ground to which it is to be applied be as equal as possible in quality and condition.

Reports to be lodged by 1st May in any year.

9. MANURE MADE WITH AND WITHOUT COVER.

For an approved Report on the comparative value of manure made in the ordinary manner, and of manure kept under cover till applied to the land—Twenty Sovereigns.

The experiment may be conducted either with manure made in the open straw-yard, contrasted with that made in covered hammels or boxes, or with manure made in feeding-houses, part of which shall have been placed under cover, and part removed to the open dung-pit, and kept carefully unmixed with any other manure. Preference will be given to experiments embracing both of these modes. The cattle must be fed and littered alike. There must be at least an acre of land experimented on with each sort of manure—the different lots must be manured to the same extent, and be of equal quality of soil, and on two separate portions of each, not less than 20 poles; the crops must be accurately weighed and measured. The result, as given by two successive crops, to be reported.

Reports to be lodged by 1st May in any year.

10. SHELL AND CORAL SAND.

For an approved Report on the application of Shell or of Coral Sand as a fertilizer—The Gold Medal, or Ten Sovereigns.

The Report must state the quantity of shell or coral sand available in a district, its composition, the best mode of applying it, the expense of the application, and the results obtained, as compared with those of an experiment with the same crop in similar land without the application. The price at which the sand can be purchased, and the facilities for exporting it, to be stated.

Competitors to send samples of the sand experimented with to Dr Anderson.

Reports to be lodged by 1st November 1860.

11. TOP-DRESSING FOR PASTURE.

For an approved Report on the substances which may be most profitably employed in Top-dressing pasture—The Gold Medal, or Ten Sovereigns.

The Report must state the nature of the substances used, the time and cost of the application, and the comparative results, which must be contrasted with those obtained from a portion of the same field to which no top-dressing was applied.

The substances recommended for trial are guano, nitrate of soda, sulphate of ammonia, superphosphate of lime, sulphate of potash, and muriate of potash, but competitors are not restricted to these or any other substances.

Reports to be lodged by 1st November 1860.

12. AUTUMN MANURING.

For an approved Report on the comparative advantages of applying manure to the stubble in Autumn, or in the drills in Spring for turnips, potatoes, or beans—Twenty Sovereigns.

The experiment must extend over three years, and comprise,—1*st*, the green crop; 2*d*, the grain crop; 3*d*, the clover crop. It must be conducted on not less than four acres—one-half of which shall be dunged in autumn, and the other in spring, with equal weights of manure, made as nearly as possible in the same way, and from animals fed on substances of equivalent nutritive values. The quantities and kinds of special manures applied at any period of the rotation must be the same on each lot, and must be stated. The treatment and condition of the land prior to the experiment must be mentioned.

As the object of this premium is to determine the advantages, if any, of autumn manuring, there will be no restriction as to labouring the land, but the Reporter must state how that was done on each lot during the experiment.

Reports to be lodged by 1st November 1860.

13. MANURES FOR GREEN CROPS.

For an approved Report of experiments for determining the kinds and qualities of manures calculated, irrespective of expense, to raise the largest and soundest green crop—whether Turnip or Potato—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1861.

14. IMPROVED VARIETIES OF AGRICULTURAL PLANTS.

For an approved Report on the means successfully employed for obtaining new and superior varieties, or improved sub-varieties, of any of the cereal grains, grasses, roots, or other agricultural plants —The Gold Medal, or Ten Sovereigns.

It is necessary that the varieties and sub-varieties reported upon shall have been proved capable of reproduction from seed, and also that the relation they bear to others, or well-known sorts, should be stated. The Reporter is further requested to mention the effects that he may have observed produced by different soils, manures, &c., on the plants forming the subjects of reports, and how far he may have ascertained such effects to be lasting.

Should any improved variety reported upon be the result of direct experiment by cross impregnation, involving expense and long-continued attention, a higher premium will be awarded.

Reports to be lodged by 1st November 1860.

15. DIFFERENT KINDS OF WHEAT.

For an approved Report of experiments conducted for the purpose of determining the relative productiveness in corn and straw of Hunter's, Hopetoun, Fenton, and any other variety of White Wheat—Twenty Sovereigns.

The Experiment must embrace crops 1861 and 1862. Intention to compete must be intimated to the Secretary not later than 1st January 1861. The soil shall be uniform in quality and condition. One acre must be allowed for each kind of wheat. and the lots must be separated by spaces not less than two feet wide. Care must be taken to select true samples of seed for crop 1861, the produce of which shall be used as seed in 1862. Samples of the original seed, and of each year's crop, to be lodged with the Report. The wheats to be sown, by drill, not later than November, and the crops shall be inspected by a committee in May and July following. The whole produce shall be weighed and measured; and care must be taken thoroughly to cleanse the thrashing-machine previous to testing each variety. The Report shall further specify the quantity of each variety of seed sown—where it was obtained—the dates of sowing, earing, ripening—the properties and appearances of the crops when growing—and the produce each year in corn and straw.

Reports to be lodged by 1st November 1862.

16. INTERMEDIATE CROP OF TURNIP, RAPE, ETC.

For an approved Report on the best mode of cropping land with an intermediate crop of Turnip, Rape, &c., when a white crop is intended to follow an early lifted crop of Potatoes—The Gold Medal, or Ten Sovereigns.

The Report must show the effect on the after white crop, as com-

pared with the results on a part of the same land from which no intermediate crop shall be taken.

Reports to be lodged by 1st November 1860.

17. COMPARATIVE PRODUCTIVENESS, ETC., OF POTATOES.

For an approved Report on the comparative productiveness, and general qualities for use and keeping, of the different kinds of potatoes used in field culture, and the results observable on the white crops following different varieties of Potatoes—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1861.

18. COMPARATIVE PRODUCTIVENESS, ETC., OF TURNIPS.

For an approved Report of the comparative productiveness, keeping, and other qualities, of the different kinds of Swedish, Yellow, and White Turnips, generally used in field culture, and the results observable on the white crops following different varieties—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1861.

19. MANGOLD-WURZEL.

For an approved Report on the cultivation of Mangold-Wurzel in Scotland—The Gold Medal, or Ten Sovereigns.

The Reporter must state the nature and previous preparation of the soil—the varieties grown—the period of sowing—the quantity of seed per acre, and mode of sowing—the time and mode of thinning and cleaning—the best means of preventing seeding—the time and manner of storing—the crop obtained—and its comparative value for feeding purposes.

Reports to be lodged by 1st May 1861.

20. CABBAGE.

For an approved Report on the cultivation of the Cabbage as a field crop—The Gold Medal, or Ten Sovereigns.

The experiment must be conducted on not less than one acre, and contrasted with a like extent under turnips in the same field.

Both lots must have been under one rotation, and must be prepared and manured in the same manner.

Reports to be lodged by 1st May 1861.

21. TURNIP FLY.

For an approved Report on the natural history of the Turnip Fly, and on the best means of arresting its ravages—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1861.

22. GRASS WITH OR WITHOUT A WHITE CROP.

For an approved Report on the comparative advantages of sowing down for Pasture, with or without a cereal crop. The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

23. VEGETABLE PRODUCTIONS OF INDIA, CHINA, AMERICA, &c.

For an approved Report on the Hardy and useful Herbaceous Plants, including Grains and Grasses of China, Japan, the Islands of the Eastern Archipelago, the Himalaya Country, the Falkland and South Sea Islands, California, the high north-western districts of America, or any other country where such climate exists as to induce the belief that the plants may be beneficially introduced into the cultivation of Scotland—The Gold Medal, or Ten Sovereigns.

Reporters are required to give the generic and specific names of the plants treated of, with the authority for the same—together with the native names, in so far as known; and to state the elevation of the locality and nature of the soil in which they are cultivated, or which they naturally inhabit, with their qualities or uses; and it is further requested that the descriptions be accompanied, in so far as possible, with specimens of the plants, and their fruit, seed, or other products.

Reports to be lodged by 1st November in any year.

FEEDING STOCK.

The experiments specified in Nos. 24, 25, 26, 27, and 28, must be conducted over a period of not less than three months. No lot shall consist of fewer than four Cattle, or five Sheep. The animals selected should be of the same age, sex, and breed, and, as nearly as possible, of the same weight, condition, and maturity. Their live weight before and after the experiment must be stated, and, if killed, their dead weight and quantity of tallow.

24. BEST MODES OF HOUSING FATTENING CATTLE.

For an approved Report on the comparative advantages of fattening Cattle in stalls, in loose houses or boxes, and in sheds or hammels—Twenty Sovereigns.

The Report must detail the comparative result of actual experiments. The same quantities and kinds of food shall be used. Information is required as to the comparative expense of attendance, the cost of erecting the buildings, and any other circumstances deserving of attention. The state of the weather during the experiment in point of temperature and wetness must be particularly noted and reported.

Reports to be lodged by 1st May 1861.

25. DIFFERENT DESCRIPTIONS OF FOOD.

For an approved Report of experiments for ascertaining the actual addition of weight to growing or fattening stock, by the use of different kinds of food—Twenty Sovereigns.

The attention of the experimenter is directed to turnips, carrots, beet, mangold-wurzel, potatoes, cabbage, as well as to beans, oats, barley, indian corn, linseed, oil-cake, or rape-cake, and to the effect of warmth and proper ventilation, and the difference between food cooked and raw. The above roots and other kinds of food are merely suggested; Competitors are neither restricted to them, nor obliged to experiment on all of them.

When experiments are made with linseed and cake, attention shall be paid to the comparative advantages, economically and otherwise, of the substances in these two states.

Before commencing the comparative experiments, the animals must be fed equally for sometime previously.

The progress of different breeds may be compared; this will form an interesting experiment of itself, for Reports of which encouragement will be given.

Reports to be lodged by 1st May 1861.

26. COMPARATIVE FEEDING QUALITIES OF LINSEED-CAKE AND RAPE CAKE.

For an approved Report on the comparative feeding qualities of Linseed Cake and of Rape Cake, to be ascertained by feeding two lots of Cattle on Turnips, and on each of these substances—The Gold Medal or Ten Sovereigns.

Reports to be lodged by 1st May 1861.

27. COMPARATIVE FEEDING QUALITIES OF TURNIP, MANGOLD, AND CABBAGE.

For an approved Report of experiments for determining the comparative feeding qualities of Turnip, Mangold, and Cabbage—The Gold Medal, or Ten Sovereigns.

The experiment may be made either with Cattle or Sheep. The land on which the crops were grown must have undergone the same treatment and preparation, and the weight per imperial acre of each crop should be stated.

Reports to be lodged by 1st May 1861.

28. COMPARATIVE FATTENING QUALITIES OF PURE AND CROSS-BRED SHEEP.

For an approved Report of experiments for determining the comparative fattening qualities of pure and cross-bred Sheep—The Gold Medal, or Ten Sovereigns.

One lot must consist of any pure breed, the other of any cross between that and another breed. The same descriptions of food must be given; the quantities consumed, and the increase in the weight and value of each lot must be carefully noted.

Reports to be lodged by 1st May 1861.

DISEASES OF SHEEP FED ON TURNIPS.

For an [illegible] Report on [illegible] nature, symptoms, causes, preventive and [illegible], and *post mortem* appearances, of the Diseases to which [illegible] are subject when fed on Turnips, and of the conditions of [illegible] under which such dis-

eases are most apt to manifest themselves—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1861.

30. RED WATER IN CATTLE.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment of Red Water in Cattle—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1860.

31. BLACK LEG IN CATTLE AND SHEEP.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, of Black Leg or Quarter Ill in Cattle and Sheep—The Gold Medal or Ten Sovereigns.

Reports to be lodged by 1st November 1860

32. RURAL ECONOMY ABROAD.

For an approved Report, founded on personal observation, of any useful practice in Rural or Domestic Economy, adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal.

The purpose chiefly contemplated by the offer of this premium is to induce gentlemen who may visit other countries to notice and record such particular practices as may seem calculated to benefit their own country.

Reports to be lodged by 1st November in any year.

SECTION 2. WOODS AND PLANTATIONS.

1. EXTENSIVE PLANTING.

For an approved Report by a Proprietor who shall, within the five preceding years, have planted the greatest extent of ground, not being less than 150 acres. The whole planting operations that may have been conducted by the Reporter within the five years, whether completed or not, must be embraced, and he must state the

expense—description of soil—age, kind, and number of trees planted per acre—mode of planting, draining, and fencing—and general state of the plantation—and any other observations of interest—The Gold Medal.

Reports to be lodged by 1st November in any year.

2. FORMATION AND MANAGEMENT OF YOUNG PLANTATIONS.

For an approved Report of Plantations formed within a period of not more than ten, nor less than five years preceding the date of the Report—The Gold Medal, or Ten Sovereigns.

The Report should comprehend every interesting particular; among others, the exposure, altitude, and general climate of the locality—the previous character and condition of the soil and subsoil—a detailed statement of the expense, including that of enclosing, draining, and fencing, and a specification of the manner in which these operations were performed—the mode of planting adopted—the prevailing weather while planting, and for a month after the operation—the kind of trees planted, and the number of each kind per acre—their relative progress—the proportion of blanks and deaths at the end of three years—the system of management—the state of the plantations at the date of making the Report—and any other observation of interest.

Reports to be lodged by 1st November in any year.

3. GENERAL MANAGEMENT OF PLANTATIONS.

For an approved Report of the management of Plantations, from the commencement of the first thinning till the period of yielding full-grown timber—The Gold Medal, or Ten Sovereigns.

The Report should embrace the following points:—The annual progress of the different sorts of trees—the effects of altitude and exposure—the general advantages of shelter—the mode of thinning and pruning adopted—the uses and value of the thinnings—the plan of registry and of valuing, or a specimen of the method in which the forester's book is kept—the valuation at the time of the Report—together with such general remarks as may be thought useful.

The Report is not expected to embrace the formation and early management, further than the description of soil, kinds of plants, whether mixed or in masses, together with a note of the expense from the time of planting to the commencement of the first thin-

ning, in so far as such information is in the possession of the Reporter.

Reports to be lodged by 1st November in any year.

4. USES AND VALUE OF TIMBER.

For an approved Report on the economic uses and comparative value of different descriptions of Timber grown in Scotland—The Gold Medal, or Ten Sovereigns.

This premium may be regarded as a sequence to Nos. 2 and 3; the object being to obtain the practical and economic results of forming and of managing woods, by ascertaining the purposes to which they have been applied, and the pecuniary returns they have yielded.

The Reporter, besides stating the actual results of his own observation and experience, should indicate the objects which planters ought to have in view with reference to profitable return, by stating the kinds of trees that should be planted—the periods at which they should be cut—the purposes to which they should be applied—and the returns that may be looked for, in different localities, and under different circumstances.

There must be a general description of the management, soil, altitude, exposure, &c., of the particular woods reported on, and attention is directed to the difference supposed to exist in the quality of natural and planted timber

Reports to be lodged by 1st November in any year.

5. MIXED AND UNMIXED PLANTATIONS.

For an approved Report on mixed and unmixed Plantations—The Gold Medal, or Ten Sovereigns.

As wood in a state of natural growth, both at home and abroad, is generally found unmixed, each variety occupying the soil or situation best adapted to its growth, the idea of planting on a mapped system is suggested. The Reporter will state his experience in grouping plantations—his opinion of the advantages of the system compared with mixed planting—and the soils and situations and exposures most suitable for different kinds of hard and soft wood.

Reports to be lodged by 1st November in any year.

6. COMPARATIVE QUALITIES OF SCOTCH, AUSTRIAN, AND CORSICAN FIR.

For an approved Report on the comparative value, for economical purposes, of the Scotch, Austrian, and Corsican Fir, and on their adaptation to different soils and situations—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November in any year.

7. PLANTING WITHIN THE INFLUENCE OF THE SEA OR ON BARREN TRACTS.

For an approved Report on successful Planting within the influence of the sea, or on exposed sterile tracts, founded on observation of the habits and appearance of the different sort of trees considered best suited for such situations—The Gold Medal or Ten Sovereigns.

The plantations reported on must not be less than ten years old.

Information is particularly desired regarding the species and varieties of trees calculated for growing in situations unfavourable to most of those generally cultivated, as bleak heaths, sandy links, exposed maritime situations, and high northern exposures.

The Reporter must specify the extent of planting and mode of drainage and fencing—the nature of the soil and subsoil—the elevation and exposure of the locality—its distance from the sea; and—if in his power, he should notice the underlying rocks, and the geological features of the district.

Reports to be lodged by 1st November in any year.

8. ARBORETUM.

For an approved Report on the most varied, extensive, and judiciously arranged collection of forest and ornamental trees, either *species* or marked *varieties*, of not less than eight years' standing in Scotland—The Gold Medal, or Ten Sovereigns.

The Arboretum must be formed so as to afford ample space for the full development of the specimens. The report must specify the nature of the locality—its altitude and exposure—the description and previous preparation of the soil—the date of planting—the system of draining—fencing—and pruning—and any other cir-

cumstances which may be supposed to influence the growth of the plants; the number of failures, with the periods when, and circumstances under which, these occurred, must also be reported. Information should be added, when in the Reporter's possession, as to the age and average height of the specimens—whether they are seedlings, cuttings, layers, or grafted plants—and, if possible, the stock on which they have been grafted.

The Report must be accompanied with a correct list, containing the names of the different species and varieties, with an authority for each, and a plan showing the disposition of each specimen. The trees in the Arboretum must be numbered and named relative to the list and plan.

Reports to be lodged by 1st November in any year.

9. PRUNING CONIFERÆ.

For an approved Report on the pruning of the rarer Coniferæ—The Gold Medal, or Ten Sovereigns.

The Reporter must consider the propriety of pruning Coniferæ as a general question, and the effects produced by pruning and by non-pruning. He will state the kinds of Coniferæ best adapted for pruning, and the period of the year, the age of the tree, and the circumstances under which it should be done; he will also report on the comparative effects of pointing and pruning, and the best method of pointing when that system is adopted.

Reports to be lodged by 1st November in any year.

10. DISEASES OF FOREST TREES.

For an approved Report on the diseases incidental to forest trees, and the injuries they sustain from the attacks of Insects—The Gold Medal, or Ten Sovereigns.

The Report must state the kinds of trees most generally liable to attack—the parts first affected—the age of the tree and period of the season when first observed—the state of the drainage—the altitude and exposure of the locality, and its geological formation—the nature of the soil and subsoil—when and how the trees were pruned—the remedies, preventive and remedial, which may have been tried. Information is required as to the causes of decay—whether attacks of insects, or cryptogamic growth—and how far either of these causes may have been induced by the

previous sickly or stunted condition of the tree. Attention is directed to the Beech, Larch, Silver Fir, and White Pine (*Pinus Strobus*), and to the Coniferæ generally, and particularly to the stripping the leaves from Scotch and other pines by the pine-leaf caterpillar.

Reports to be lodged by 1st November in any year.

11. PLANTING PEAT MOSS.

For an approved Report on Plantations, of not less than eight years' standing, formed on deep peat moss—The Gold Medal, or Ten Sovereigns.

It being understood that large tracts of peat moss have been profitably planted in England and Holland, it is considered desirable to obtain information on the subject. The Premium is strictly applicable to deep peat or flow moss; the condition of the moss in its original state, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

Reports to be lodged by 1st November in any year.

12. WILLOWS.

For an approved Report on the cultivation of Willows, and their most advantageous employment for basket and other industrial purposes—The Medium Gold Medal, or Five Sovereigns.

The Report must state the nature of the soil and subsoil—the time and mode of planting—the expense per acre—the best varieties—and the most profitable applications.

Reports to be lodged by 1st November 1860.

13. HEDGES.

For an approved Report on the various Plants which may be advantageously used for Hedges, and on the best mode of Hedge-

management under different circumstances—The Gold Medal, or Ten Sovereigns.

The Reporter will direct his attention to the most suitable means for treating old and dilapidated hedges with a view to restoration.

Reports to be lodged by 1st November 1860.

14. FOREST TREES OF RECENT INTRODUCTION.

For an approved Report on the more extended introduction of hardy, useful, or ornamental trees, which have not hitherto been generally cultivated in Scotland—The Gold Medal, or Ten Sovereigns.

The Report should specify, as distinctly as possible, the kind of trees introduced. The nature of the plantation should likewise be described, as to soil, exposure, shelter, and elevation above the level of the sea. The adaptation of the trees for use or ornament, and their comparative progress, should be mentioned. Attention is directed to the introduction into use of any tree as a nurse in young plantations, which, by growing rapidly for several years, and attaining maturity when at the height of 20 or 25 feet, might realize the advantages and avoid the evils of thick planting.

Reports to be lodged by 1st November in any year.

15. IMPORTATION OF SEEDS.

To the person who shall send to the Society seeds capable of germination, either of new or recently-introduced Coniferæ, or of the rarer kinds of forest trees—The Medium Gold Medal.

Before the Premium is awarded, the number of seedling plants of each species raised by the Society shall not have been less than 50. Seeds of Coniferæ may be sent home in the cones, wrapped in brown paper, packed in a box, to be kept in a cool, airy part of the cabin, but on no account in the hold, nor in close tin cases. Hasty and severe heating in extracting seeds from the cone should be carefully avoided. Seeds of hardwood may be packed in brown paper, or in sphagnum (moss), or they may be mixed with soil and placed in strong boxes.

Seeds may be forwarded at any time.

16. OLD AND REMARKABLE TREES.

With the view of obtaining and publishing facts connected with

the history, progress, and present condition, of old and remarkable trees in Scotland, the Directors issued schedules to enable Members and other parties to report. Valuable and interesting information has been thus obtained, and is in course of arrangement for publication; but in many instances the schedules have not been returned, and it is hoped that those gentlemen in whose hands they are will yet transmit them to the Secretary with such details as may be in their power to communicate. For the guidance of Members generally, the following instructions and relative schedule are submitted:—

The following trees may be reported on.—Oak, Elm, Ash, Sycamore, Maple, Chestnut, Horse-Chestnut, Beech, Walnut, Hornbeam, Tulip Tree, Locust Tree (*Robinia*), Birch, Evergreen Oak, Yew, Scotch Fir, Silver Fir, Spruce Fir, Balm of Gilead, White Pine, Larch, Poplar, Willow, and other trees of old growth.

Column 2 will embrace height, girth, spread of branches, and, if possible, a calculation of the contents of timber.

Column 3 will state the age as nearly as can be ascertained, or inferred on reasonable grounds.

Column 6 will, in addition to elevation, describe the shelter.

Column 8 will state whether the tree is vigorous, increasing or decaying, and if it bears marks of having been pruned.

Column 9 will state the name of the Farm or Estate, and nearest Post-town or Railway Station.

1. Name of Tree.	2. Size.	3. Age.	4. Soil.	5. Sub-soil.	6. Altitude.	7. Exposure.	8. Present Condition.	9. Where Growing.	10. General Remarks.

17. GROWTH OF RECENTLY INTRODUCED CONIFERÆ.

With the view of ascertaining the progress of Coniferæ introduced within the last 30 years, and the most suitable relations of soil, altitude, exposure, &c., Members of the Society and others are requested to forward, in the subjoined form, whatever information they can afford, with the view to its being tabulated and published.

The details required for old and remarkable trees equally apply to the following schedule. The following trees may be reported on :—

Araucaria imbricata, Cedrus Deodara, Abies Douglassi, A. Menziesii, A. Morinda, Picea nobilis, P. cephalonica, P. Pinsapo, Pinus Laricio, P. excelsa, P. Lambertiana, P. monticola, P. ponderosa, Cupressus torulosa, C. macrocarpa.

Name of Tree.	Seedling or Transplanted	Where Seed or Plant got.	Age.	Size.	Soil.	Subsoil.	Altitude.	Exposure	Present Condition.	Where Growing.	General Remarks.

18. ROOTS OF CONIFERÆ.

For an approved Report of experiments on the uses to which the fibrous parts of the roots of Coniferous Trees may be applied—The Gold Medal, or Ten Sovereigns.

In North-West America, the fibrous parts of the roots of some of the Coniferous trees are extensively employed for purposes similar to those to which willows are applied in this country, more particularly when the wood has been grown in soft peaty soils. The object of the premium is to elicit information regarding the possibility of profitably extracting, and applying to economic purposes the vast quantities of roots left in the ground.

Reports to be lodged by 1st November in any year.

SECTION 3. LAND IMPROVEMENTS.

1. GENERAL IMPROVEMENT OF ESTATES.

To the Proprietor who shall report the most judicious, successful, and extensive improvement of an Estate—The Gold Medal, or Ten Sovereigns.

The merits of the Report will not be determined so much by the mere extent of the improvements as by their character, and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, build-

ing, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

Reports to be lodged by 1st May in any year.

2. RECLAMATION OF WASTE LAND BY TILLAGE.

1. For an approved Report by a Proprietor or Tenant of the reclaiming, within the six preceding years, of not less than fifty acres of Waste Land—The Gold Medal, or Ten Sovereigns.

2. For an approved Report by a Tenant of the reclaiming, within the four preceding years, of not less than twenty acres of Waste Land—The Medium Gold Medal, or Five Sovereigns.

3. For a similar Report by a Tenant of the reclaiming of not less than ten acres—The Silver Medal.

The Reports may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the land reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot consist of different patches of land, the improvement must have relation to one subject, it must be of a profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return*, and a certified measurement of the ground are requisite.

Reports to be lodged by 1st May in any year.

3. IMPROVEMENT OF WASTE LAND WITHOUT TILLAGE.

1. For an approved Report of the improvement, within the three preceding years, of the pasturage of not less than thirty acres, by means of Top-Dressing, Draining, or otherwise without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns.

2. For an approved Report of a similar improvement of not less than ten acres—The Silver Medal.

Reports must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

Reports to be lodged by 1st May in any year.

SECTION 4. AGRICULTURAL MACHINERY.

1. INVENTION OR IMPROVEMENT OF IMPLEMENTS OF HUSBANDRY.

For approved Reports of such inventions or improvements, by the Reporters, of any Agricultural Implement or Machine as shall be deemed by the Society of public utility—Medals, or sums not exceeding, in all, Fifty Sovereigns.

Reports may be lodged with the Secretary at any time, and should be accompanied by drawings and descriptions of the implement or machine, and, if necessary, by a model.

2. BEST CONSTRUCTION OF PLOUGH.

For an approved Report on different descriptions of Ploughs for different purposes—The Gold Medal, or Ten Sovereigns.

The attention of Competitors is particularly called to the importance of obtaining increase of depth with the least possible increase of draught. The Reporter must consider the merits of swing-Ploughs, as compared with English wheel-Ploughs; and the comparative advantages of the Scotch Ploughs, which give a high crested shoulder, and which give a rectangular shoulder. The best description of Subsoil and Trench Ploughs may also be adverted to.

Reports to be lodged by 1st November 1860.

CLASS II.

DISTRICT COMPETITIONS.

(Grants in aid of District Competitions for 1861 *must be applied for before* 1*st December next.)*

SECTION 1. CATTLE.

DISTRICTS.

1. *The Middle Ward of Lanarkshire, and the Parish of Lesmahagow.*
2. *The County of Elgin.*
3. *The County of Fife.*
4. *The District of the Spey, Avon, and Fiddochside Society.*
5. *The District of the Border Union Society.*
6. *The District of the Clackmannanshire Society.*
7. *The District of the Auchterarder Society, and adjoining Parishes.*
8. *The District of the Perth, Fife, Kinross, and Clackmannan Association.*
9. *The County of Peebles.*
10. *The District of Cowal.*
11. *The District of the Royal Northern Society.*
12. *The District of the Deeside Association.*
13. *The District of Lorn.*
14. *The District of the Mar Association.*
15. *The Districts of Kintail, Lochalsh, and Applecross.*

Conveners of Committees.

FIRST DISTRICT—Patrick Graham Barns of Limekilns.
SECOND DISTRICT—Robert Grant of Kincorth.
THIRD DISTRICT—Alexander Bethune of Blebo.
FOURTH DISTRICT—James Skinner, Drumin.

FIFTH DISTRICT—Lord Polwarth.
SIXTH DISTRICT—James Johnstone of Alva.
SEVENTH DISTRICT—Viscount Strathallan.
EIGHTH DISTRICT—Lord Kinnaird, K.T.
NINTH DISTRICT—Sir Graham Graham Montgomery, Bart., M.P.
TENTH DISTRICT—Alexander S. Finlay of Castle Toward, M.P.
ELEVENTH DISTRICT—Alexander Thomson of Banchory.
TWELFTH DISTRICT—Sir James H. Burnett, Bart.
THIRTEENTH DISTRICT—Dugald Macdougall of Gallanach.
FOURTEENTH DISTRICT—Archibald Grant of Tillyfour.
FIFTEENTH DISTRICT—Alexander Matheson of Ardross, M.P.

1. For the best Bull, of any pure Breed, not exceeding eight years old, belonging to a Proprietor or Factor—The Silver Medal.

2. For the best Bull, of any pure Breed, calved before 1st January 1858, and not exceeding eight years old, belonging to a Tenant or Proprietor farming the whole of his own lands, £8.

3. For the second best, ... £4.

4. For the best Bull of any pure Breed, calved after 1st January 1858 belonging to a Tenant or Proprietor farming the whole of his own lands, ... £5.

5. For the best pair of Heifers, of any pure Breed, of two years old (if Highland breed, three years), belonging to a Tenant or a Proprietor farming the whole of his own lands, £5.

6. For the second best, ... £3.

The Society's Premiums are granted to each District for three alternate years, on condition that the Districts shall, in the two intermediate years, continue the Competitions by offering for the same description of stock a sum not less than one-half of that given by the Society.

At the Intermediate Competitions, a Silver Medal will be placed at the disposal of the Committee to be awarded to the best lot exhibited.

In 1860,

No. 1 is in competition for the last year.
Nos. 2, 3, 4, 5, 6, 7, and 8, for the second year.
Nos. 9, 10, 11, and 12, for the first year.

Nos. 13, 14, and 15, compete for local premiums.

RULES OF COMPETITION.

1. The members of the Society connected with the respective Districts are appointed Committees of superintendence for regulating the Competitions; three members to be a quorum.

2. The Convener of each District shall summon a meeting of Committee, for the purpose of determining the time and place of Competition, the nomination of Judges, and other preliminary arrangements. The time and place shall be publicly intimated by Conveners, in such a manner as may appear to them most effectual.

3. The Competitions must take place before the 1st of November. The animals exhibited must belong to one of the following pure Breeds—Shorthorn—Ayrshire—Polled (Galloway, Angus or Aberdeen)—Highland. The Bulls may be of one Breed, and the Heifers of another. The Committee shall select the Breed, and specify it in the returns.

4 Stock of an inferior description, or which does not fall within the prescribed regulations, shall not be placed for Competition. The Premiums shall not be divided. *No Money Premium shall be adjudged unless there are three Lots exhibited, and not more than one-half unless there are six* A Competitor may exhibit two Lots in each Class. For the Medal, two Lots authorise an award.

5. An animal which has gained the Society's first Premium at a previous District or General Show is inadmissible in the same class, except for the Medal; and one which has gained a Second Money Premium can only thereafter compete in that class for the first.

6. A Tenant may compete with Proprietors and Factors for the Medal with a Bull which has gained the first Money Premium at a previous Show. When there is any doubt as to whether a Competitor should be ranked as a Proprietor or a Tenant, the point is left to the decision of the Local Committee. Factors can only compete for the Medal.

7. A Bull, the property of two or more Tenants, may compete, although the Exhibitors may not be joint tenants. Bulls not belonging to the District may compete, provided they are left within it for service.

8. Bulls for which the Money Premiums are awarded, must serve in the District at least one season; the rate of service may be fixed by the Committee.

9. Should it be proved that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Committee or Judges as to its qualification or properties, the case shall be reported to the Directors, to be dealt with by them in terms of Regulation No. 13 for General Shows.

10. If an animal has been disqualified on any previous occasion, such disqualification shall attach unless communicated to the Committee, in terms of Regulation No. 14 for General Shows.

11. Blank Reports and Returns will be furnished to the Conveners of the different Districts. These must, in all details, be completed and lodged with the Secretary on or before the 15th of November next.

12. A Report of the Competition and Premiums awarded at the *intermediate* Local Shows, in the several Districts, signed by a member of the Society, must be transmitted to the Secretary on or before the 15th of November in each year, otherwise the Society's grant shall terminate.

13. It is to be distinctly understood, that in no instance does any claim lie against the Society for expenses attending a Show of Stock, beyond the amount of the Premiums offered; and that all Premiums not applied for within two years from the term of payment (1st January 1861) shall be forfeited.

SECTION 2. DRAUGHT HORSES.

DISTRICTS.

1. *The County of Stirling.*
2. *The County of Forfar.*
3. *The Island of Bute.*
4. *The County of Caithness.*
5. *The County of Kincardine.*

Conveners of Committees.

FIRST DISTRICT—John Stirling of Kippendavie.
SECOND DISTRICT—Sir John Ogilvy, Bart., M.P.
THIRD DISTRICT—Thos. Gibson of Spittal.
FOURTH DISTRICT—Alexander Henderson of Stemster.
FIFTH DISTRICT—Sir Thomas Gladstone, Bart.

Forty Sovereigns (of which twenty are contributed by the Local Associations) will be awarded as follows:-

1. For the best Stallion, for agricultural purposes, not under three years and nine months, and not above twelve years old, £25.
2. For the best Brood Mare, for agricultural purposes. £10.
3. For the best Filly, foaled after 1st January, 1858, . £5.

In 1860,

Nos. 1, 2, and 3, are in competition for the last year.
Nos. 4, and 5, for the first year.

RULES OF COMPETITION.

1. The Members of the Society in the District are appointed a Committee of Superintendence, as in No. 1 of the Regulations for the Cattle Competitions; and they shall be convened in the same manner, and for purposes similar to those indicated in the said Regulations.

2. The time and place of Competition for the respective Districts shall be fixed by the Convener, with the concurrence of the Committee, and published by him in due time, and in such manner as shall be thought most effectual for the information of those interested. The Competition for Stallions, and that for Mares and Fillies, may be held at different periods.

3. If fewer than three animals be exhibited in any class, half the Premium only can be awarded. The Regulations for Cattle Shows, regarding previous intimation to the Committee and Competitors—the exclusion of stock, if of inferior character—reporting false entries—extra expenses—the period within which Premiums must be applied for—and the manner in which the Reports are to be certified and transmitted to the Society—are severally applicable to the Premiums for Horses. Evidence must be produced that the Prize Stallions have had produce. Mares must have foals at their feet, or be entered as being in foal; in the latter case, payment of the Premium will be deferred till certificate of birth.

ENTIRE COLTS.

The Society being anxious to promote the improvement of Draught Horses by encouraging the rearing of Entire Colts, Stallion premiums are limited to a period of two years, and followed by premiums for other two years within the same district for Entire Colts.

The District of Kintyre.

Convener of Committee.

John Lorn Stewart of Coll.

1. For the best Entire Colt, for agricultural purposes, foaled after 1st January 1858, . . . £6
2. For the best Entire Colt, for agricultural purposes, foaled after 1st January 1859, . . . £4

If fewer than three animals are exhibited in either class, only half the Premium can be awarded. The other regulations for Horses are generally applicable.

SECTION 3. SHEEP.

1. LEICESTER BREED.

DISTRICTS.

1. *The County of Ayr.*
2. *The County of Forfar.*
3. *The District of the Perth, Fife, Kinross, and Clackmannan Society.*
4. *The County of Haddington.*
5. *The Counties of Berwick and Roxburgh.*

Conveners of Committees.

FIRST DISTRICT—James Campbell of Craigie.
SECOND DISTRICT—Colonel Kinloch of Kilrie.
THIRD DISTRICT—Lord Kinnaird, K.T.
FOURTH DISTRICT—James W. Hunter of Thurston.
FIFTH DISTRICT—John Wilson of Cumledge.

1. For the best Tup, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age, . . . £5
3. For the best two Shearling Tups, . . £5
4. For the best Pen of five Ewes, not less than two Shear, £5

5. For the best Pen of five Gimmers or Shearling Ewes, £4

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own lands.

In 1860,

No. 1 is in competition for the last year.
Nos. 2 and 3 for the second year.
No. 4 for the first year.

No. 5 competes for local Premiums.

2. CHEVIOT BREED.

DISTRICTS.

1. *The County of Selkirk.*
2. *The Islands of Islay, Jura, and Colonsay.*
3. *The Districts of Mull and Morven.*
4. *The Districts of Gairloch and Lochbroom.*
5. *The District of Nithsdale.*
6. *The District of Annandale.*
7. *The Districts of Eskdale and Liddesdale.*

Conveners of Committees.

First District—James Ballantyne of Holylee.
Second District—Richard D. Campbell of Jura.
Third District—Farquhar Campbell of Aros.
Fourth District—Sir Kenneth S. Mackenzie of Gairloch, Bart.
Fifth District—Wm. Maxwell of Carruchan.
Sixth District—John J. Hope Johnstone of Annandale, M.P.
Seventh District—James Connell of Conheath.

In 1860,

No. 1 is in competition for the second year.
No. 2 for the first year.

Nos. 3 and 4 compete for local Premiums.
Nos. 5, 6, and 7 are in abeyance, on account of the Dumfries Sho

1. For the best Tup, belonging to a Proprietor or Fact
The Silver Medal.

2. For the best Tup of any age, . . . £5
3. For the best two Shearling Tups, . . £5
4. For the best Pen of five Ewes, not less than Two Shear, £5
5. For the best Pen of five Gimmers or Shearling Ewes, £4

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

3. BLACK-FACED BREED.

DISTRICTS.

1. *The District of Athole.*
2. *The Districts of Breadalbane and Weem.*
3. *The County of Dumbarton.*
4. *The Districts of Badenoch and Rothiemurchus.*
5. *The District of the Strathearn Society.*
6. *The Island of Arran.*
7. *The District of the Gatehouse Society.*

Conveners of Committees.

First District—The Duke of Athole, K.T.
Second District—James F. Wyllie, Bolfracks.
Third District—Alexander Smollett of Bonhill.
Fourth District—Cluny Macpherson.
Fifth District—D. R. Williamson of Lawers.
Sixth District—James Paterson, Whitehouse.
Seventh District—Walter M'Culloch of Ardwall.

1. For the best Tup, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age, . . £5
3. For the best two Shearling Tups, . . £5
4. For the best Pen of five Ewes, not less than Two Shear, £5
5. For the best Pen of five Gimmers or Shearling Ewes, . £4

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own Lands.

In 1860,

Nos. 1 and 2 are in competition for the last year.
No. 3 for the second year.
Nos. 4 and 5 for the first year.

No. 6 competes for local Premiums.
No. 7 is in abeyance on account of the Dumfries Show.

RULES OF COMPETITION.

1. The Members of the Society in the several Districts are appointed Committees of Superintendence, as in Nos. 1 and 2 of the Regulations for Cattle Competitions, and they shall be convened by their respective Conveners in the same manner and for the same purposes as specified in these regulations.

2. The Competition shall take place before the 1st of November, and the time and place must be publicly intimated by each Convener within his District

3. Tups shall have served the usual number of Ewes for at least three weeks during the previous season. All prize Tups must serve within the District. The Competitions are open to Tups not belonging to the District, provided they are left for service. Ewes must have reared Lambs during the season Ewes and Gimmers must be taken from regular breeding hirsels.

4. The Premiums shall not be divided. No Money Premiums shall be adjudged unless there are three lots exhibited, and only one-half if there are not six lots. Each Competitor may show two lots. For the Medal two lots authorise an award. The other Regulations for Cattle Competitions—in regard to the placing of Stock—the exclusion of Animals which have gained Premiums at previous shows—the right of a Tenant, under certain circumstances, to compete for the Medal – reporting false entries—the Regulation as to expenses—the number of lots required for full or half Premiums—the period within which Premiums must be applied for—and the manner in which the Reports must be certified and transmitted—are applicable to the Premiums for Sheep.

5. The Society gives these Premiums for three alternate years in each District, if, during the intervening years premiums are awarded by the District to an amount not less than one-half of the Society's Premiums, and for the same description of the Stock. Reports of these intermediate Competitions must be lodged by the 15th of November, or the Society's grant shall terminate.

6. Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of November.

4. SHEARING SHEEP.

The Silver Medal will be given to the best Sheep-shearer in each of the Districts in which the Premiums for sheep are in operation.

CONDITIONS.

1. Money Premiums must be awarded by the District at each Competition, to the amount of not less than £2.

2 The District Convener will fix the time and place of Competition, and make all necessary arrangements.

3 The Medal shall not be awarded unless there are three Competitors, and it shall always accompany the highest Money Premium. If two or more lots

appear to be equally well executed, preference should be given to that executed within the shortest time.

4. The Conveners shall report the particulars of the Competition and the award of the Judges to the Society, along with the Report of the Sheep Premiums in the District.

SECTION 4. SWINE.

DISTRICTS.

1. *The County of Renfrew.*
2. *The County of Edinburgh.*

Conveners of Committees.

FIRST DISTRICT—Allan Pollok of Faside.
SECOND DISTRICT—R. B. Wardlaw Ramsay of Whitehill.

1. For the best Boar belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Boar, ... £4
3. For the second best, ... £2
4. For the best Breeding Sow, . . . £3
5. For the second best, . . . £1

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

In 1860,

No. 1 is in competition for the last year.
No. 2 for the second year.

The above Premiums are given to each District for three consecutive years.

The Regulations for Cattle Competitions, pages 34 and 35, are to be held as applicable to the Premiums for Swine; and the Convener and Committee of the Society's Members in the Districts are accordingly referred to them.

Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts. These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of November.

CLASS III.

DAIRY PRODUCE.

DISTRICTS.

1. *The District of the Forbes and Fordyce Association.*
2. *The County of Ayr.*
3. *The District of the West Kilbride Society.*
4. *The District of the Glasgow Society.*
5. *The District of Kintyre.*

Conveners of Committees.

FIRST DISTRICT—Sir John Stuart Forbes of Pitsligo, Bart.
SECOND DISTRICT—James Campbell of Craigie.
THIRD DISTRICT—Patrick Graham Barns of Limekilns.
FOURTH DISTRICT—Mark Sprot of Garnkirk.
FIFTH DISTRICT—John Lorn Stewart of Coll.

BUTTER.

1. For the best sample of Cured Butter (not less than 14 lbs.) belonging to a Proprietor or Factor—The Silver Medal.
2. For the best sample of Cured Butter (not less than 14 lbs.) belonging to a Tenant, or Proprietor farming the whole of his own lands, ... £3
3. For the second best, ... £2

CHEESE.

4. For the best couple of Sweet Milk Cheeses belonging to a Proprietor or Factor, . . The Silver Medal.
5. For the best couple of Sweet Milk Cheeses belonging to a Tenant, or Proprietor farming the whole of his own lands, £3
6. For the second best, ... £2

CONDITIONS.

1. The above Premiums are given to each District for three consecutive years.

2. The Members of the Society, resident within the Districts, are appointed Committees of Superintendence, for the purposes expressed in the Regulations for Cattle competitions.

3. Competitors must certify that the Butter and Cheese exhibited by them are average specimens of the produce of their Dairies in 1860; and that the quantity produced during the season has not been less than 1 cwt. of butter, or 2 cwt. of cheese. Cheese may be made either in the Scotch or English mode, provided they be of full milk only, and without any admixture of cream. The Committee shall fix such general regulations as they may consider proper—and, in particular, the time and place of competition. In the event of two or more competing lots being deemed equal in quality, the Premium shall be awarded to the Competitor who has made the larger quantity. The successful Competitors, before receiving the Premiums, are required to transmit to the Secretary a detailed Report of the whole process followed by them in the manufacture of their Butter or Cheese.

4. Reports of the award of the Premiums to be lodged with the Secretary on or before the 15th November 1860.

CLASS IV.

CROPS AND CULTURE.

1. SEEDS.

The Society, with a view of aiding Local Associations in the improvement of the different Grains, Grasses, Roots, &c., offers the Silver Medal to the Grower of the best Seeds for which Premiums in money shall have been awarded in the following districts :—

1. County of INVERNESS: Convener, Arthur Forbes of Culloden.
    1. Any variety of Wheat.
    2. Any variety of Barley.
    3. Any variety of Oats.
    4. Perennial Rye Grass.

2. County of NAIRN: Convener, W. A. Stables, Cawdor Castle
    1. Any variety of Wheat.
    2. Any variety of Barley.
    3. Any variety of Oats.
    4. Perennial Rye Grass.

3. County of ELGIN: Convener, C. L. Cumming Bruce of Roseisle, M.P.
    1. Any variety of Wheat.

2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

4. County of ROXBURGH : Convener, Lord Polwarth.
1. Any variety of Wheat.
2. Any variety of Barley.
3. Any variety of oats.

5. County of FIFE : Convener, Alex. Bethune of Blebo.
1. Any variety of Wheat.
2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

6. County of WIGTOWN : Convener, Viscount Dalrymple.
1 Any variety of Wheat.
2 Any variety of Barley.
3. Any variety of Oats
4 Perennial Rye Grass.

7. County of AYR : Convener, James Campbell of Craigie.
1. Any variety of Wheat
2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

8. County of FORFAR : Convener, Thos. Macpherson Grant of Craigo.
1. Any variety of Wheat.
2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

9. County of STIRLING : Convener, J. Arch. Stuart Nicolson of Carnock.
1. Any variety of Wheat.
2. Any variety of Barley.
3. Any variety of Oats.
4. Any variety of Beans.

CONDITIONS.

1. In each District, the Convener shall fix the time and place of Competition, appoint the Judges, and make all other necessary arrangements, in concurrence with the other Members of the Society, and the local Association of the District. Conveners will be furnished with blank Schedules for reporting the awards.

2. The quantity shown in Competition by each Grower must not be less than three quarters of each variety of Grain, or two quarters of Beans or Grass-seeds. To authorise the award of the Medal, there must at least be two Competitors. The first Premium awarded by the District shall not be less than £1 for each kind of grain for which a Medal is claimed.

3. The Judges shall be guided in their awards—*1st*, By the purity of the Seed; *2d*, By its freeness from extraneous seeds; and, *3d*, Where there is an equality in these respects, by the weight. Competitors must have previously certified that the Grains, Beans, or Grasses exhibited are fair average specimens of what have been thrashed, and that the lots have in no way been picked or sorted.

4. Successful Competitors must immediately transmit, free of expense, two quarts of each kind of seed, addressed to the Secretary at the Society's Museum, George IV. Bridge, Edinburgh.

5. The Returns must show, as accurately as possible, the produce per imperial acre, also the altitude, exposure, and nature of the soil on which the crops were raised, together with the dates of sowing and reaping, and the weight per bushel. The varieties for which Premiums have been given must be named. Reports of the several Competitions must be lodged by the 15th of November.

6. The Medals will be continued in each District for five consecutive years. Applications from other Districts must be lodged with the Secretary of the Society by 1st December next.

2. GREEN CROPS ON SMALL POSSESSIONS.

With the view of improving the cultivation of small possessions by the introduction of Green Crops, the following Premiums, one-half of which is contributed by the respective Districts, will be awarded:—

For the best Green Crop, . . .	£3 0
For the second best do., . . .	£2 10
For the third best do., . . .	£1 10
For the fourth best do., . . .	£1 0

DISTRICTS.

1. The Parishes of KENMORE and KILLIN, including the portion of the Parish of WEEM on Loch Tay—Convener, James F. Wyllie, Bolfracks.
2. The Island of SKYE—Convener, Lord Macdonald, or his Factor.

3. The *Quoad Sacra* Parish of New Pitsligo—Convener, Sir John Stuart Forbes of Pitsligo, Bart.
4. The Mainland, or any of the Islands of Orkney—Convener, David Balfour of Balfour, and J. G. Heddle of Melsetter.

CONDITIONS.

1. The Competition to be limited to Tenants occupying not more than 40 acres of land, and to be under the charge of the Society's Members in the different districts.

2. At least one-half of the Green Crop to be Turnips, and that portion which is in Green Crop in 1860 should be sown out, with sufficient quantities of Clovers and Rye Grass, with the White Crop in 1861.

3. Should there be only one Competitor, the Committee may allow him such portion of one of the Premiums as they may think merited. The Committee may withhold all or any portion of the Premiums.

4. Inspectors, to be fixed by the respective Committees, shall decide the Premiums.

5. The awards to be intimated to the Secretary of the Society on or before the 15th of November in each year, and Conveners are particularly requested to state in their Reports the proportion of each lot cropped, as above mentioned, and to offer any suggestions which they may consider of importance.

3. PLOUGHING COMPETITIONS.

The Silver Medal will be given to the Winner of the first Premium at Ploughing Competitions, where there are fifteen Ploughs and Premiums to the amount of Three Sovereigns. To authorise the issue of the Medal, a Report, in the following terms, must be made to the Secretary, within one month of the date of the Competition, by a Member of the Society:—

I of Member of the Highland and Agricultural Society, hereby certify, that I attended a Ploughing Competition at on the when ploughs competed; of land was assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz.:—

[Here enumerate the names and designations of successful Competitors.]

A Ploughman is to receive no assistance, and his work is not to be touched by others.

In estimating the work, attention should be directed to its sufficiency below, as well as to its neatness above the surface.

On land of average tenacity, the rate of ploughing should not be less than an imperial acre in ten hours.

A Ploughman cannot carry more than one Medal in the same season.

A Member can only report one Match in the same season.

4. REAPING-MACHINES.

With the view of encouraging the management of Reaping-Machines, the Silver Medal will be given to the Servant found most expert at a trial, when not less than Four Machines have been worked, and Premiums to the amount of Two Sovereigns are awarded. Reports must be lodged with the Secretary by a Member who has inspected the work, not later than the first of November.

5. MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society being anxious to co-operate with local Associations in their efforts to promote improvement, will give a limited number of Silver Medals annually, in addition to the Money Premiums which may be awarded to Tenants by such Associations—

1. STOCK.—To any local Society, not on the list of District Competitions, awarding for Pure Breeds of Stock premiums not less than £10, and reporting their Show to the Secretary—The Silver Medal.

   Applied for by the Forbes and Fordyce Association—Convener, Sir John Stuart Forbes of Pitsligo, Bart.

   The Western District of Mid-Lothian—Convener, Peter M'Lagan of Pumpherston.

   The Penicuik Society—Convener, The Right Hon. Sir George Clerk, Bart.

   The District of Breadalbane and Weem—Convener, James F. Wyllie, Bolfracks.

   The Buchan Society—Convener, George Baird of Strichen.

2. For the best managed FARM—The Silver Medal.

   Applied for by the Nairnshire Society—Convener, Wm. Alexander Stables, Cawdor Castle.

   The Inverness Society—Convener, Arthur Forbes of Culloden.

   The Carrick Society—Convener, P. W. Kennedy of Drumellan.

   The East Kilpatrick Society—Convener, Archibald Campbell Colquhoun, yr. of Killermont.

3. For the best managed DAIRY—The Silver Medal.

   Applied for by the Bute Society—Convener, Thomas Gibson of Spittal.

   The Mauchline Society—Convener, Colonel Ferrier Hamilton.

4. For the best managed GREEN CROP—The Silver Medal.

Applied for by the Bute Society—Convener, Thomas Gibson of Spittal.

The Inverness Society—Convener, Arthur Forbes of Culloden.

The District of Breadalbane—Convener, James F. Wyllie, Bolfracks.

The Dalrymple Society—Convener, James Campbell of Craigie.

The East Kilpatrick Society—Convener, Archibald Campbell Colquhoun, yr. of Killermont.

The Leochel-Cushnie Society—Convener, Arthur Forbes Gordon of Rayne, W.S.

The Clackmannan Society—Convener, James Johnstone of Alva.

5. For the best managed HAY CROP—The Silver Medal.

Applied for by the Clackmannanshire Society—Convener, James Johnstone of Alva.

6. For the best kept FENCES—The Silver Medal.

No application.

7. For the best managed DUNGHILL—The Silver Medal.

Applied for by the District of Breadalbane—Convener James F. Wyllie, Bolfracks.

8. To the Labourer most expert and efficient in opening and filling Drains, and otherwise executing the works necessary in thorough Draining—The Silver Medal.

Applied for by the Nairnshire Society—Convener, Wm. Alex. Stables, Cawdor Castle.

The Carrick Society—Convener, P. W. Kennedy of Drumellan.

9. To the Labourer most expert in Cutting Hedges—The Silver Medal.

No Application.

The Medals to be issued will be limited to ten in each class. Reports of the several Competitions, and applications for 1860, must be lodged by 1st November next. The money Premiums given in the District must be £2 in each case, and in No. 1., £10.

CLASS V.

COTTAGES AND GARDENS.

The following Premiums are offered for competition in the Parishes after mentioned. The Medals and one-half of the Premiums are given by the Society, and the other half is contributed by the respective Parishes.

COTTAGES.

1. For the best kept Cottage in each Parish—One Pound Five Shillings; and where there are four competitors—The Silver Medal.
2. For the second best—One Pound.
3. For the third best—Fifteen Shillings.

GARDENS.

1. For the best kept Cottage Garden in each Parish—One Pound Five Shillings; and where there are four Competitors—The Silver Medal.
2. For the second best—One Pound.
3. For the third best—Fifteen Shillings.

Aberdeenshire.

FORGUE—Convener, Robert Simpson of Cobairdy.

Fifeshire.

FALKLAND—Convener, Francis Howden, Falkland.
NEWBURGH and ABDIE—Convener, Dr Lyell, Newburgh.

Lanarkshire.

LAMINGTON—Convener, Alexander Baillie Cochrane of Lamington, M.P.
LESMAHAGOW—Convener, W. E. Hope Vere of Blackwood.
COVINGTON—Convener, Sir Wyndham Carmichael Anstruther, Bart.

Perthshire.

ST MARTINS—Convener, William Macdonald Macdonald of St Martins.

Wigtownshire.

KIRKCOLM—Convener, David Guthrie, Stranraer.
LESWALT—Convener, Sir Andrew Agnew of Lochnaw, Bart., M.P.
PORT-PATRICK—Convener, Sir Edward Hunter Blair, Bart.
Old LUCE—Convener, Captain Dalrymple Hay, younger of Park Place.

CONDITIONS.

1. Competitions may take place in the different Parishes for Cottages and Gardens, or for either separately.

2. In either case, the occupiers of Gentlemen's Lodges and Gardeners' Houses are excluded, as well as Gentlemen's Servants occupying Cottages in the Policies, or on land in the natural possession of their masters. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judge.

3. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, shall not exceed £5 sterling. A Competitor who has gained a Premium in a previous year cannot compete again for the same or a lower Premium.

4. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is of thatch, it must be in good repair, though in the occupation of a tenant. The interior and the external conveniences must be clean and orderly—the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to competitors who, in addition to the above requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

5. In estimating the claims for the Garden Premiums, the Judges should have in view—the sufficiency and neatness of the fences; the cleanness of the ground, and neatness of the walks; the quality of the crops, and general productiveness of the garden; and the choice of crops.

6. Reports, stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary on or before 1st of November next.

Parishes desirous of these Premiums must lodge applications with the Secretary on or before the 1st November next.

MEDALS FOR COTTAGES OR GARDENS.

The Society will issue annually twelve Medals to local Associations or individuals, who at their own expense establish Premiums for Cottages or Gardens.

The Medals will be issued upon a Report by a Member of the Society, in the terms required by the preceding conditions, describing the merits of the Cottages or Gardens. The Reports to be lodged with the Secretary on or before the 15th October 1860.

Applied for by The Linlithgow Society.
Lord Kinnaird.
Mrs Douglas Baird of Closeburn.
Lanark Horticultural Society.
Eastern District of Stirling.
The Proprietors of Lundin.
The Parishes of Forglen and Alvah.
Mauchline Horticultural Society.
The Newburgh Gardening Society.
The Conan Garden Society.

IMPROVING EXISTING COTTAGES.

To the Proprietor in Scotland who shall Report the Improvement of the greatest number of Cottages in the years 1857, 1858, and 1859—The Gold Medal.

BUILDING NEW COTTAGES.

To the Proprietor in Scotland who shall report the Erection of the greatest number of approved Cottages during the years 1856, 1857, 1858, and 1859—The Gold Medal.

CONDITIONS.

Claims for the above Premiums must be lodged with the Secretary on or before the 1st of October next, to allow an inspection to be made of the different Cottages. The inspection will be conducted by a Committee of the Society's Members, and Reports must be transmitted to the Secretary on or before the 1st November.

The annual value of the Cottage or Cottages separately, with the garden ground, must not exceed £5.

In estimating the claims of Competitors, the following points will be kept in view :—The external appearance of the Cottages, their internal accommodation ; the arrangements of the outhouses ; the means of drainage and ventilation ; and the expense of the building or of the alteration, compared with its durability and accommodation. When the Cottages of one Competitor are superior in style and comfort to those of another, though not so numerous, the Inspectors will give them the preference, provided they amount at least to three, and have been erected at a moderate expense.

Parties competing will forward plans, specifications, and estimates to the Society, of which, and of all information sent therewith, copies may be taken for publication, if the Society shall see fit, and the originals returned to the parties within six months if desired.

ACCOMMODATION FOR FARM-SERVANTS.

To the Proprietor in Scotland who shall have Erected on his estate the most approved Farm-buildings in reference to the proper accommodation of Farm-Servants—The Gold Medal.

Reports, Plans, and Specifications to be lodged by the 1st November 1860.

AGRICULTURAL MEETING

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

AT

DUMFRIES,

ON THE 1ST, 2D, AND 3D OF AUGUST 1860.

President of the Society.
HIS GRACE THE DUKE OF ATHOLE, K.T.

Chairman of the Local Committee.
THE RIGHT HON. THE EARL OF DALKEITH.
Lord Lieutenant of Dumfriesshire.

Convener of the Local Committee.
THE RIGHT HON. THE EARL OF SELKIRK.
Lord Lieutenant of the Stewartry.

The District connected with the Show will comprise DUMFRIESSHIRE, the Stewartry of KIRKCUDBRIGHT, and WIGTONSHIRE.

GENERAL ARRANGEMENTS.

IMPLEMENTS

Will be placed in the Yard on 27th and 28th July; judged and tried on 30th and 31st July; exhibited on 1st, 2d, and 3d August.

STOCK

Will be placed in the Yard on the afternoon of the 31st, or before Seven o'clock on the morning of the 1st; judged between Seven and Two o'clock on the 1st; exhibited from Two till Five on the 1st, and from Seven till Four on 2d August.

PRIZE STOCK, IMPLEMENTS, ETC.,

Will be exhibited from Nine till One on 3d August.

The Competition is open to Exhibitors from all parts of the United Kingdom.

No Certificate of Entry can be received after Wednesday 13th June.

Members of the Society have free access to the Show-Yard, and are exempted from Entry-Money of 2½ per cent. on Premiums.

Tenants, Members of the Society, may obtain Tickets for Farm Servants at 6d. See Rule No. 2.

CLASS I.—CATTLE.

POLLED GALLOWAY.

Section		
1	Best Bull calved before 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, ...	The Silver Medal.
2	Best Bull calved after 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best Bull calved after 1st Jan 1859,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third Best, ...	The Bronze Medal.
4	Best Cow of any age, ...	Fifteen Sovereigns.
	Second best, ...	Eight Sovereigns.
	Third best, ...	The Bronze Medal.
5	Best Heifer calved after 1st Jan. 1858,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best Heifer calved after 1st Jan. 1859,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

POLLED ANGUS OR ABERDEEN.

7	Best Bull calved before 1st. Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, . . .	The Silver Medal.
8	Best Bull calved after 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
9	Best Bull calved after 1st Jan. 1859,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
10	Best Cow of any age, ...	Fifteen Sovereigns.
	Second best, ...	Eight Sovereigns.
	Third best, ...	The Bronze Medal.
11	Best Heifer calved after 1st Jan. 1858,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
12	Best Heifer calved after 1st Jan. 1859,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

SHORT-HORN.

SECTION		
13	Best Bull calved before 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, ...	The Silver Medal.
14	Best Bull calved after 1st Jan. 1858,	Twenty Sovereigns.
	Second Best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
15	Best Bull calved after 1st Jan. 1859,	Ten Sovereigns.
	Second Best, ...	Five Sovereigns.
	Third Best.	The Bronze Medal.
16	Best Cow of any age, ...	Fifteen Sovereigns.
	Second best, ...	Eight Sovereigns.
	Third best, ...	The Bronze Medal.
17	Best Heifer calved after 1st Jan. 1858,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
18	Best Heifer calved after 1st Jan. 1859,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

AYRSHIRE.

19	Best Bull calved before 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, . . .	The Silver Medal.
20	Best Bull calved after 1st Jan. 1858,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
21	Best Cow in Milk of any age, . . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
22	Best Cow in Calf of any age, . . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
23	Best Heifer calved after 1st Jan. 1858,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
24	Best Heifer calved after 1st Jan. 1859,	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

HIGHLAND.

Section		
25	Best Bull calved before 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, ...	The Silver Medal.
26	Best Bull calved after 1st Jan. 1858,	Ten Sovereigns.
	Second best, ...	Five Sovereigns
	Third best, ...	The Bronze Medal.
27	Best Cow of any age, ...	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
28	Best Heifer calved after 1st Jan. 1857,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best,.	The Bronze Medal.
29	Best Heifer calved after 1st Jan. 1858,	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

MEDALS FOR EXTRA STOCK.

30	Best Cross Ox calved after 1st Jan. 1857, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
31	Best Cross Ox calved after 1st Jan. 1858, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
32	Best Polled Ox calved after 1st Jan. 1857, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
33	Best Polled Ox calved after 1st Jan. 1858, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.

CLASS II.—HORSES,

FOR AGRICULTURAL PURPOSES.

Section		
1	Best Stallion foaled before 1st Jan. 1857,	Thirty Sovereigns.
	Second best,	Fifteen Sovereigns.
	Third best,	The Bronze Medal.
	Breeder of the best Stallion,	The Silver Medal.
2	Best Entire Colt foaled after 1st Jan. 1857,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
3	Best Entire Colt foaled after 1st Jan. 1858,	Fifteen Sovereigns.
	Second best,	Eight Sovereigns.
	Third best,	The Bronze Medal.
4	Best Entire Colt foaled after 1st Jan. 1859,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
5	Best Mare (with Foal at foot), foaled before 1st Jan. 1857,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
6	Best Mare (in Foal), foaled before 1st Jan. 1357,	Fifteen Sovereigns.
	Second best,	Eight Sovereigns.
	Third best,	The Bronze Medal.
7	Best Filly foaled after 1st Jan. 1857,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
8	Best Filly foaled after 1st Jan. 1858,	Eight Sovereigns.
	Second best,	Four Sovereigns.
	Third best,	The Bronze Medal.
9	Best Filly foaled after 1st Jan. 1859,	Six Sovereigns.
	Second best,	Three Sovereigns
	Third best,	The Bronze Medal.

CLASS III.—SHEEP.

*CHEVIOT.

Section		
1	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
2	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
4	Best pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

BLACKFACED.

5	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
7	Best pen of Five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
8	Best pen of five Shearling Ewes or Gimmers,.	Eight Sovereigns.
	Second best.	Four Sovereigns.
	Third best	The Bronze Medal.

LEICESTER.

9	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
10	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.

11	Best pen of five Ewes, not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
12	Best pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

LONG-WOOLLED OTHER THAN LEICESTER.

13	Best Tup not more than four shear,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
14	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
15	Best pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
16	Best pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

SOUTHDOWN.

17	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
18	Best Dinmont or Shearling Tup, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
19	Best pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
20	Best pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

CLASS IV.—SWINE.

Section		
1	Best Boar, large breed, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
2	Best Boar, small breed, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best Sow, large breed, ...	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
4	Best Sow, small breed.	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
5	Best pen of three Pigs, not exceeding 8 months old, large breed, . . .	Four Sovereigns.
	Second best, ...	Two Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best pen of three Pigs, not exceeding 8 months old, small breed, . . .	Four Sovereigns.
	Second best, ...	Two Sovereigns.
	Third best, ...	The Bronze Medal.

CLASS V.—POULTRY.

Coloured Dorking.

Section		
1	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
2	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best.	The Bronze Medal.

White Dorking.

3	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
4	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

Coloured Cochin-China.

5	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
6	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

White Cochin-China.

Section		
7	Best Cock and 2 Hens,	The Silver Medal.
	Second best,	The Bronze Medal.
8	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second best,	The Bronze Medal.

Bramahpootra.

9	Best Cock and 2 Hens,	The Silver Medal.
	Second best,	The Bronze Medal.
10	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second best,	The Bronze Medal.

Malay.

11	Best Cock and 2 Hens,	The Silver Medal.
	Second best,	The Bronze Medal
12	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second best,	The Bronze Medal.

Spanish.

13	Best Cock and 2 Hens,	The Silver Medal.
	Second best,	The Bronze Medal.
14	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second best,	The Bronze Medal.

Golden Hamburg.

15	Best Cock and 2 Hens.	The Silver Medal.
	Second best,	The Bronze Medal.
16	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second best,	The Bronze Medal.

Silver Hamburg.

17	Best Cock and 2 Hens,	The Silver Medal.
	Second best,	The Bronze Medal.
18	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second best,	The Bronze Medal.

Polish.

19	Best Cock and 2 Hens,	The Silver Medal.
	Second best,	The Bronze Medal.
20	Best Cockerel and 2 Pullets,	The Silver Medal.
	Second Best,	The Bronze Medal.

GAME.

SECTION		
21	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
22	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

ANY OTHER BREED.

23	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
24	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

BANTAMS.

25	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
26	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

CAPONS—*Of any Breed.*

27	Best 3 Capons, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

DUCKS—*White Aylesbury.*

28	Best Drake and 2 Ducks, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

ROUEN DUCKS.

29	Best Drake and 2 Ducks, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

ANY OTHER BREED.

30	Best Drake and 2 Ducks, ...	The Silver Medal.
	Second best	The Bronze Medal.

TURKEYS—*Black Norfolk.*

31	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

TURKEYS—*Any other Breed.*

32	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

Geese.

Section		
33	Best Gander and 2 Geese, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

CLASS VI.—DAIRY PRODUCE.

Section		
1	Best sample of Cured Butter, . . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
2	Best sample of Powdered Butter, . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best sample of Fresh Butter, . . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
4	Best Two Sweet Milk Cheeses, .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
5	Best Two Skimmed Milk Cheeses, .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best Two English Cheeses, . . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
7	Best Two Imitation English Cheeses,	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

CLASS VII.—IMPLEMENTS AND MACHINES.

When an Implement exhibits any original and important improvement, the Judges may recommend an honorary Premium in addition to the Money.

The Bronze Medal will be given as a Second Prize in each Section.

Section		
1	Best Two-Horse Plough for general purposes, ...	Two Sovereigns.
2	Best Trench or Deep Furrow Plough, .	Two Sovereigns.
3	Best Subsoil Plough for Two Horses, .	Two Sovereigns.
4	Best Subsoil Plough for Three or Four Horses, ...	Three Sovereigns.
5	Best Double Mould-Board Plough, . .	Two Sovereigns.
6	Best Ribbing Plough, ...	Two Sovereigns.

Section		
7	Best Two-Horse Grubber or Cultivator, .	Three Sovereigns.
8	Best Norwegian Harrow, or Pulverising Land Roller, ...	Three Sovereigns.
9	Best Consolidating Land Roller, . . .	Four Sovereigns.
10	Best Land Presser for preparing Seed-bed for Grain, ... , . . .	Four Sovereigns.
11	Best Ribbing Machine, ...	Two Sovereigns.
12	Best Harrows for Heavy Land, . . .	Two Sovereigns.
13	Best Harrows for Light Land, ...	Two Sovereigns.
14	Best Harrows for covering Grass Seeds,	Two Sovereigns.
15	Best Common Swing-Trees for Two Horses, ...	One Sovereign.
16	Best Equalising Swing-Trees for more than Two Horses, ...	One Sovereign.
17	Best Broadcast Sowing-Machine for Grain,	Five Sovereigns.
18	Best Drill Sowing-Machine for Grain, .	Five Sovereigns.
19	Best Sowing-Machine for Grass Seeds, .	Five Sovereigns.
20	Best Sowing-Machine for Turnips, . .	Three Sovereigns.
21	Best Sowing-Machine for Turnips with Manure, ...	Five Sovereigns.
22	Best Dibbling or Drop Sowing-Machine with Manure, ...	Three Sovereigns.
23	Best Sowing-Machine for Mangold, . .	Three Sovereigns.
24	Best Sowing-Machine for Carrots, . .	Three Sovereigns.
25	Best Three-row Sowing-Machine for Beans,	Two Sovereigns.
26	Best One-row Sowing-Machine for Beans,	One Sovereign.
27	Best Machine for Pulverising Guano, &c.,	Two Sovereigns.
28	Best Machine for Distributing Guano in drill or broadcast, ...	Five Sovereigns.
29	Best Liquid Manure Distributing-Machine, ...	Four Sovereigns.
30	Best Horse-Hoe for Drilled Grain Crops,	Four Sovereigns.
31	Best Horse-Hoe for Green Crops, . .	Two Sovereigns.
32	Best Machine for Singling Turnips, . .	Four Sovereigns.
33	Best Machine for Raising Potatoes, .	Four Sovereigns.
34	Best Scythe for general purposes, . .	One Sovereign.
35	Best Reaping-Machine, Self-delivery, .	Ten Sovereigns.
36	Best Reaping-Machine, Manual-delivery,	Ten Sovereigns.
37	Best Horse Stubble or Hay Rake, . .	Two Sovereigns.
38	Best Thrashing-Machine, for Two or more Horses, ...	Five Sovereigns.
39	Best Thrashing-Machine, with Steam Power, ...	Twenty Sovereigns.
40	Best Fanners or other Machine for Winnowing Grain, ...	Three Sovereigns.

SECTION		
41	Best Fanners or other Machine for Cleaning Grass-Seeds, ...	Three Sovereigns.
42	Best Weighing-Machine for Grain, .	Two Sovereigns.
43	Best Weighing-Machine, indicating from 1 lb. to 2 tons, ...	Four Sovereigns.
44	Best Straw-Cutter for Hand-labour, .	Two Sovereigns.
45	Best Straw-Cutter for Power, . . .	Three Sovereigns.
46	Best Turnip-Cutter for Cattle, . . .	Two Sovereigns.
47	Best Turnip-Cutter for Sheep, . . .	Two Sovereigns.
48	Best Turnip-Cutter for Sheep, attachable to a Cart, ...	Three Sovereigns.
49	Best Machine for Pulping Turnips, . .	Two Sovereigns.
50	Best Root-Washer, ...	Two Sovereigns.
51	Best Linseed-Bruiser for Hand-labour, .	Two Sovereigns.
52	Best Oil-Cake Bruiser for Hand-labour,	Two Sovereigns.
53	Best Grain Grinder or Bruiser for Power,	Five Sovereigns.
54	Best Steaming-Apparatus for Food, . .	Five Sovereigns.
55	Best Feeding-Troughs for Byres, . .	One Sovereign.
56	Best Feeding-Troughs for Sheep, . .	One Sovereign.
57	Best Sheep Fodder-Rack, ...	Two Sovereigns.
58	Best Churn worked by Hand, ...	Two Sovereigns.
59	Best Churn worked by Power, . . .	Three Sovereigns.
60	Best Cheese-Press, ...	One Sovereign
61	Best General Set of Dairy Utensils, .	Two Sovereigns.
62	Best One-Horse Cart, with Harvest Frame,	Four Sovereigns.
63	Best Harvest-Cart, ...	Four Sovereigns.
64	Best Light Spring-Cart, ...	Two Sovereigns.
65	Best Wheel-Barrow of Malleable Iron,	One Sovereign.
66	Best Barrow for conveying Cooked Food,	One Sovereign.
67	Best Divisions, Rack, and Manger, for Farm Stables, ...	Two Sovereigns.
68	Best Farm Harness, ...	One Sovereign.
69	Best Stack-Pillars, with Framework, .	Two Sovereigns.
70	Best Field-Gate, constructed entirely of Iron, ...	One Sovereign.
71	Best Field-Gate, not constructed entirely of Iron, ...	One Sovereign.
72	Best Dunghill-Gate, to open at different elevations, ...	One Sovereign.
73	Best Iron Hurdles for Cattle-Fence, .	One Sovereign.
74	Best Iron Netting for Sheep-Fence, . .	One Sovereign.
75	Best Wooden Hurdles or other Fencing for Sheep, ...	One Sovereign.
76	Best Pipe or Tile Machine for Hand or Power, ...	Five Sovereigns.

SECTION	
77 Best Pipes for Conveying Water under Pressure, ...	Three Sovereigns.
78 Best Tiles and Pipes for Field Drainage,	Two Sovereigns.
79 Best Glazed Socketed Pipes for Sewerage, ...	Three Sovereigns.
80 Best Tools for Cutting Field Drains, .	One Sovereign.
81 Best Tools for Cutting Open Drains in Hill Pastures, ...	One Sovereign.
82 Best General Set of Hand Implements for the Farm, ...	Two Sovereigns.
83 Best Gas Apparatus for Country Houses and Farm Steadings, ...	Five Sovereigns.

SPECIAL PREMIUM

By the Right Hon. Lord Ashburton to the Inventor of the best Drag for the common Cart, to be exhibited in working order. £10.

EXTRA STOCK AND IMPLEMENTS.

STOCK and IMPLEMENTS not included in the Sections for Competition may be exhibited as EXTRA, and will receive Honorary Premiums when specially commended.

GENERAL REGULATIONS.

1. Members of the Society are admitted to the Show-Yard without payment on exhibiting a "*Member's Ticket.*" Tickets will be sent to all Members residing in the District connected with the show—Dumfriesshire, the Stewartry, and Wigtownshire. Members residing in other localities must apply for Tickets at the Secretary's Office not later than the 20th of July.

2. Tenant Farmers who are Members of the Society, and who reside within the District of the Show, may obtain Tickets of Admission to the Yard for their Farm-Servants at Sixpence each, on applying at the Secretary's Office, No. 6 Albyn Place, or to Alex. Simpson, Esq., Dumfries, between 1st of June and 20th July. The names of the persons for whom the Tickets are required must be specified, and they will be available for Thursday 2d August only.

3. Stock must be the property, and in the possession, of the Exhibitor from the date of the Certificate of Entry, and the exact age must be stated in the Certificate.

4. Evidence may be required that Stallions and Bulls have had produce.

5. Animals entered in any Section for Cows must have had Calves previous to the Show, and when exhibited, they must either be in milk or in calf; if in milk, birth must have been within 9 months previous to the Show; if in calf, it must be certified within 9 months after it.

6. Heifers in Section 17 (two-year-old Short-Horn heifers) must be in calf when exhibited, and birth must be certified within 9 months after the Show.

7. Mares in Section 5 must have foals at foot. Mares in Section 6 must be in foal, and awards will be suspended till birth is certified.

8. Ewes and Gimmers must be taken from regular breeding hirsels, and Ewes must rear lambs in 1860.

9. An Animal which has gained a first Premium at a General Show of the Society cannot again compete in the same class. The Medium Gold Medal shall be awarded to any animal, exhibited as Extra Stock, which has previously obtained the Society's first premium as an aged Bull, Stallion, or Cow.

10. No Animal shall bear on its rug, harness, or other fittings, any initial, crest, or other mark of ownership, nor be distinguished otherwise than by the number indicating its place in the Catalogue.

11. Commendations shall only be given for Extra Stock. In other classes the Judges shall restrict their awards to the Premiums offered.

12. The violation by an Exhibitor of any one of the Regulations shall involve the forfeiture of all Premiums awarded to him.

13 Should it be proved to the satisfaction of the Directors that an Animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Directors or Judges as to its qualification or properties, the case shall be reported to the first General Meeting, in order that the Exhibitor shall be disqualified from again competing at the Society's Shows, and his name, if he be a Member, struck from the roll.

14. When an animal has previously been disqualified by the decision of any Agricultural Association in Great Britain or Ireland, such disqualification shall attach, if the Exhibitor, being aware of the disqualification, fail to state it, and the grounds thereof, in his entry, to enable the Directors to judge of its validity.

15. Protests against the awards of the Judges must be lodged with the Secretary not later than Ten A.M on Thursday 2d August, and parties must be in attendance at the Committee-Room, in the Show-Yard, at Eleven, when protests shall be heard and disposed of by the Directors.

16. It will be the duty of the Secretary to see that no Member of the Society, Exhibitor, or Stranger, be present in the Yard, under any pretext, while the Judges are engaged in their inspection.

17. The Society shall not be liable for any loss or damage which Stock, Implements, or other articles may sustain.

18. The Premiums awarded will be paid after the 1st of January 1861. *Premiums not applied for within two years from the term of payment shall be forfeited.*

19. The decisions of the Judges, as confirmed by the Directors, are final, and no appeal is competent.

CERTIFICATES OF ENTRY.

20. Every Lot must be intimated by a Certificate of Entry, lodged *not later than the 13th of June.* Printed forms will be issued on application to the Secretary.

21. The Secretary will attend at Dumfries on the 12th and 13th of June, to receive and close the Entries.

22. Admission-Orders to the Yard for Stock, &c., &c., will be given when Entries are made, or forwarded by post previous to the Show.

23. Exhibitors, not members of the Society, shall pay an Entry-Money for Stock of 2½ per cent. on the highest Premium for which the Entry is made. Members may show three Lots of Stock in each Section free, but must pay the same percentage on the Premium for each additional Lot. The Entry-Money for Implements, Poultry, and Dairy Produce, is 2s. 6d. on each Lot, and Members may show one Lot free in each Section.

ACCOMMODATION FOR STOCK.

24. Covered accommodation will be provided for the whole of the Stock, and the following rates shall be paid by *all* Exhibitors at the time of making their Entries:—

	s.	*d.*
Stallions, and 3 and 2 year old entire Colts	10	0
All other Horses and Cattle 2 years old and upwards	7	6
Yearling Colts, Fillies, Bulls, and Heifers	5	0
Sheep and Swine, per pen	5	0
Poultry, per coop	2	6

25. The Yard will be open for the reception of Stock on Tuesday 31st July, and between Five and Seven o'clock on the morning of the 1st August. No Stock will be admitted after that hour.

26. Stock will be accommodated from Tuesday till Friday, and no Exhibitor shall be permitted to remove Cattle, Sheep, or Swine from the Yard till Five P.M. on Thursday, or, if Prize Stock, till One P.M. on Friday, except on certificate by the Veterinary Surgeon employed by the Directors.

27. Horses may be withdrawn at Six each evening on a deposit of £2 for each animal, which shall be forfeited if the animal is not brought back at Six o'clock the following morning.

28. Servants in charge of Stock must bring their own buckets or pails. A first bedding will be provided by the Society, but all other fodder and food for Stock will be supplied, at fixed prices hereafter to be published, by a Contractor employed by the Society.

PLACING AND JUDGING STOCK.

29. A Special Committee will superintend the placing of Stock, and will retire from the Yard as soon as the Judges enter. Exhibitors may see their Stock properly placed, but they must immediately thereafter retire: and on no pretext shall any other parties be permitted to enter the Yard until it is opened to the public.

30. One servant will be admitted with each Lot. Bulls must be secured by a ring or screw in the nose, with a chain or rope attached. The Competing Stock shall be distinguished by numbers, and the owner's name must not be mentioned till the Premiums are decided.

31. The Judges will commence their inspection at Seven o'clock on Wednesday, 1st August. They shall decide without inquiry as to the names of parties or places, and with reference merely to the numbers which distinguish the animals. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit, more especially if there is only one Lot in the Section, and it shall be in their power to suggest the removal of any Lot which appears to them unworthy of being placed in the Yard.

32. A Member of Committee will attend each Section of the Judges. It will be his duty to see that no obstruction is offered to them; to communicate to the Secretary any question that may arise for the consideration of the Directors; to complete their reports; and to ticket the prize animals. None of the tickets so placed shall be removed.

33. No Exhibitor shall act as a Judge or attending Member, nor shall he nor his Factor nor Land Steward, on any pretext whatsoever, be allowed to enter the Show-Yard, or remain in it, from the time the Judges commence their duties till Two o'clock, when the Yard will be opened to the public.

PLACING AND JUDGING IMPLEMENTS.

34. The Show-Yard will be open for the reception of IMPLEMENTS on Friday, 27th July, and all articles must be placed by Saturday Evening. No article will be admitted without an Admission-Order.

35. Exhibitors must attach to each Implement, when forwarded to the Show, a card bearing the Exhibitor's name, that of the Implement, and the No. of the Section in which it has been entered.

36. Articles entered in Competition under any Section of the Premium-List shall be arranged in the Yard according to their respective Sections, which must not be disturbed so long as Implements are kept in the Yard.

37. "*General Collections*" may be entered not to compete, which shall not be tried nor reported on. The space required for them must be intimated on or before 13th June; a moderate charge will be made for it.

38. Articles may be entered as "*Extra*" for Medals, provided they do not fall within any Section of the Premium List.

39. The Judges will commence their inspection on Monday 30th July, at Eight o'clock, and resume it the following morning at Seven. Practical utility will be considered more than mere ingenuity of design; substantial workmanship will be preferred to highly finished execution; and due weight will in all cases be given to economy, both as regards the price of the Implement, and the saving of the labour effected by it. The materials must be the same as those in ordinary use for sale, and the *bona fide* market price must be attached.

40. A trial of Implements will take place on Wednesday 1st August; and at Two o'clock the Yard will be opened to the public.

41. If the state of the crops does not admit of Reaping-Machines being worked, a trial in the neighbourhood of Dumfries will be fixed for a later period.

42 Implements may be removed from the Yard at Five o'clock on Thursday 2d August, but the Yard will be kept open for exhibition and sale till 3 o'clock on Friday.

PLACING AND JUDGING DAIRY PRODUCE.

43. Dairy Produce must be brought to the Show-Yard not later than seven o'clock on the morning of Wednesday 1st August. No Lot will be admitted without an admission-order.

44. Samples of Cured and Powdered Butter not to be less than 14 lbs. Fresh Butter to be in three ½ lb. rolls. Dairy Produce must be made on the Exhibitor's farm in 1860. At least 1 cwt. of the variety of Butter, and 2 cwt. of that of the Cheese, exhibited, must have been made during the season. The lots shall be fair samples.

45. The Judges will be in attendance at Ten, and the Exhibition will be opened to the public at One o'clock on Wednesday the 1st.

46. No article to be removed from the Yard till Five o'clock on Thursday the 2d.

PLACING AND JUDGING POULTRY.

47. Poultry may be brought to the Show-Yard on Tuesday afternoon, or between Five and Seven o'clock on the morning of Wednesday, 1st August. No Lot will be admitted without an Admission-Order. Coops, food, and attendance will be found by the Society.

48. The Judges will be in attendance at Seven, and the Exhibition will be opened to the public at Two o'clock on Wednesday the 1st.

49. No Lot to be removed from the Yard till Five o'clock on Thursday the 2d.

EXHIBITION OF PRIZE STOCK AND IMPLEMENTS.

50. All Prize Animals, Implements, and Poultry must remain in the Show-Yard till One o'clock on Friday, 3d August, or the Premiums will be forfeited.

Premium Lists, Certificates of Entry, and Regulations, may be obtained by applying at the Secretary's Office, No. 6 Albyn Place, Edinburgh, or to Alexander Simpson, Esq., Dumfries.

The Secretary will attend at Dumfries on 12th and 13th June to receive entries.

AGRICULTURAL MEETING

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

At PERTH, in 1861.

The District connected with the Show will comprize the Counties of PERTH, FIFE, KINROSS, and CLACKMANNAN, and Western part of FORFARSHIRE.

CATTLE.

Premiums in Money will be offered for the following Classes :—

SHORT-HORN.

Bulls calved before 1st January............1859.
Bulls calved after 1st January..............1859.
Bulls calved after 1st January..............1860.
Cows of any age.
Heifers calved after 1st January..........1859.
Heifers calved after 1st January..........1860.

POLLED.

Bulls calved before 1st January............1859.
Bulls calved after 1st January............1859.
Bulls calved after 1st January............1860.
Cows of any age.
Heifers calved after 1st January.........1859.
Heifers calved after 1st January.........1860.

Note.—When the Number of Galloways exceeds Three in any Section, they shall be judged separately from Polled Angus and Aberdeen.

AYRSHIRE.

Bulls calved before 1st January............1859.
Bulls calved after 1st January............1859.
Cows in Milk of any age.
Cows in Calf of any age.
Heifers calved after 1st January.........1859.
Heifers calved after 1st January.........1860.

HIGHLAND.

Bulls calved before 1st January............1858.
Bulls calved after 1st January............1858.

Bulls calved after 1st January............1859.
Cows of any age.
Heifers calved after 1st January.........1858.
Heifers calved after 1st January.........1859.

EXTRA STOCK.

Medals will be offered for the following extra classes of Cattle.

Oxen of any pure or cross-breed, calved after 1st January 1858.
Oxen of any pure or cross-breed, calved after 1st January 1859.
Oxen of any pure or cross-breed, calved after 1st January 1860.
Highland Oxen calved after 1st January........................1857.
Highland Oxen calved after 1st January........................1858.
Cross-bred Heifers calved after 1st January....................1859.
Cross-bred Heifers calved after 1st January....................1860.

HORSES.

For Agricultural Purposes.

Stallions foaled before 1st January.... 1858,
Entire Colts foaled after 1st January..... . ...1858.
Entire Colts foaled after 1st January.................1859.
Entire Colts foaled after 1st January... ....1860.
Mares with foal at foot, foaled before 1st January...1858.
Mares in foal, foaled before 1st January.............1858.
Fillies foaled after 1st January.......................1858.
Fillies foaled after 1st January.......................1859.
Fillies foaled after 1st January.......................1860.

SHEEP.

BLACK-FACED.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

CHEVIOT.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

LEICESTER.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

LONG-WOOLLED OTHER THAN LEICESTER.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers

SOUTHDOWN.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

Note.—Ewes and Gimmers to be exhibited in pens of five.

SWINE.

Boars, large breed.
Boars, small breed.
Sows, large breed
Sows, small breed.

Pigs not exceeding 8 months old, large breed.
Pigs not exceeding 8 months old, small breed.

POULTRY.

Cock and 2 Hens, Cockerel and 2 Pullets, of each of the following Breeds:—

Coloured Dorking.
White Dorking.
Coloured Cochin-China.
White Cochin-China.
Bramahpootra.
Malay.
Spanish.
Golden Hamburg.
Silver Hamburg.
Polish.
Game.
Any other distinct breed.
Bantams.
Capons.
White Aylesbury Ducks.
Rouen Ducks.
Any other breed.
Black Norfolk Turkeys.
Turkeys, any other breed.
Geese.

DAIRY PRODUCE.

Cured Butter.
Powdered Butter.
Fresh Butter.
Sweet Milk Cheese.
Skimmed Milk Cheese.
English Cheese.

Imitation English Cheese.

IMPLEMENTS.

The Premiums for Implements will be afterwards published.

AGRICULTURAL EDUCATION.

The following Bye-Laws have been enacted under the authority of the Supplementary Charter of 1856, and in terms of the Report by the Council on Education thereby created:—

1. That in terms of a Report by the Council on Education, the following Board of Examiners be appointed:—

Science and Practice of Agriculture—Mechanics and Agriculture of the Farm—Professor JOHN WILSON; GEORGE HOPE, Fenton Barns; ROBERT RUSSELL, Edinburgh; and JOHN WILSON, Edington Mains
Botany—Professor BALFOUR.
Chemistry—Professor THOMAS ANDERSON.
Natural History—Professor ALLMAN.
Veterinary Surgery—Professor DICK.
Field Engineering and Surveying—JOHN MILLER of Leithen, C.E., and JAMES STIRLING, C.E.
Book-keeping and Accounts—KENNETH MACKENZIE, Accountant, and PETER M'LAGAN of Pumpherston.

2. That it shall be competent for said Board from time to time to receive for examination, and to recommend for the Society's Agricultural Diploma, Candidates who shall have attained their 21st year, and who shall exhibit the vouchers, and pass an examination on the subjects hereinafter prescribed

3. That the vouchers to be exhibited shall be such as to afford satisfactory evidence to the Board: *1st*, That the Candidate has attended a farm, and been engaged in the practical operations thereof for a period of two years, or for two separate periods of not less than one year each. *2dly*, That the Candidate has attended, for another period of two years, or for separate periods of not less than one year each, the following classes in some seminary recognised by the Board as sufficient:—Agriculture, Chemistry, Natural History, Botany, Veterinary Medicine, and Surgery.

4. That the Candidate's knowledge of practical husbandry, and of the foregoing branches of study, as well as of Technology, Field Engineering and Surveying, Farm Mechanics and Architecture, and Book-keeping, shall be established to the satisfaction of the Board by means of a strict examination.

5. That upon a report made by the Board to the Council on Education, stating that a Candidate has exhibited the vouchers and passed the examination required, the Council shall issue, in favour of such Candidate, a diploma bearing the corporate seal of

the Society, and certifying his proficiency in the arts and sciences connected with agriculture.

In terms of the foregoing Bye-Laws, the Board of Examiners will be prepared to receive Candidates for the Diploma in the Society's Museum, George IV. Bridge, on the 28th and 29th of March. Gentlemen desirous of passing an examination must lodge their names with the Secretary on or before the 20th of March.

VETERINARY COLLEGE.

This establishment is conducted by Professor Dick, assisted by Dr Allen Dalzell, Dr Young, Mr Strangeways, and Mr Worthington. The curriculum embraces the principles and practice of Veterinary Medicine and Surgery, with Anatomy, Physiology, and Demonstrations; Chemistry; Materia Medica and Dietetics; and the general management of domesticated Animals.

Students have the advantage of assisting in an extensive practice, and of performing the different operations which most frequently occur.

Attendance on Two Courses is required before a Student is taken upon trial for diploma; the examinations are conducted by leading members of the Medical Faculty, and of the Veterinary Profession; Graduates of the College are eligible for appointment as Veterinary Surgeons in Her Majesty's Service.

MUSEUM.

The Museum, George IV. Bridge, is open from eleven till three o'clock every day, except Monday. The public are admitted on inscribing their names in the Visitors' Book. Persons desirous of preserving objects illustrative of the Vegetable products of the country are invited to transmit them to the Secretary.

MONTHLY MEETINGS.

Periodical Meetings are held in the Museum, when papers are read, and subjects in the science and practice of Agriculture are discussed. Strangers are admitted, but cannot take part in the business.

LABORATORY.

Dr Anderson, Chemist to the Society, will receive communications on all subjects connected with the Chemical Department, at the Laboratory, 15 SHUTTLE STREET, GLASGOW.

The following are the rates at which analyses, &c., are furnished to *Members of the Society*:—

1. Complete analysis of a Soil, including determination of alkalies and phosphates, £3.
2. A partial analysis of a Soil, such as the determination of the quantity of organic matter, and relative proportion of clay, sand, and carbonate of lime it contains, 10s.
3. Quantitative determination of any one ingredient of a Soil, 7s. 6d.
4. Complete analysis of Saline Manures and other substances, such as Gypsum, Nitrates of Soda and Potash, Ammoniacal Salts, Guano, Oil-Cake, Bone-Dust, Rape-Dust, Superphosphate of Lime, £1.
5. Testing any of the above substances for adulterations,—for each sample, 5s.

   This examination is sufficient to determine whether or not any of these substances are grossly adulterated, but it gives no idea of the comparative value of different Samples where all are genuine.
6. Determination of the percentage of phosphates and ammonia in a guano, 10s.

   This determination will generally show whether the sample is of fair quality, and agrees with the analysis by which it was sold, but does not fix its equal commercial value.
7. Determining the quantity of soluble and insoluble phosphates in a superphosphate, 10s.

   This determination generally suffices to show whether the sample is of fair quality, and corresponds with the

analysis by which it was sold, but not to fix its exact commercial value.

8. Complete analysis of limestones, marls, shell-sands, &c, £1.
9. Examining any of the above substances for the quantity of lime, and ascertaining in the same the presence of Magnesia and Alumina, 7s. 6d.

   Ascertaining the proportion of these, 2s. 6d. additional for each substance.
10. Complete analysis of the Ashes of any Plant, £3.
11. Complete analysis of a water, £2.
12. Determination of the amount of salts in solution, and of the lime thrown down by boiling in any water, 10s.
13. Analysis of Tile or Fire-Clay, £1, 10s.
14. Complete analysis of roots, grains, and other vegetable products, £1.
15. Examining products of Vegetation, or of the Dairy, such as nutritive matters in Wheat, or other grain—quantity of butter or cheese in milk—5s. for each ingredient.
16. Determination of the quantity of nitrogen in any substance, 7s. 6d.
17. Answers to letters asking advice on subjects within the department of the Chemist, 5s.

The charges for other analyses not specified in the list will be settled by the Committee of Management, with reference to the amount of work which they involve, and on a scale similar to the above.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

Much inconvenience and delay having been experienced by persons sending samples for Analysis which had not been sufficiently carefully selected, and were afterwards found not to represent the average composition of the substance, it is particularly requested that the following instructions may be attended to as closely as circumstances will permit:—

Manures.—A large handful of the manure should be taken from each of *at least* five or six different parts of the cargo, and if any lumps are found in it, a due proportion of these should also be taken. The whole being laid on a large sheet of paper, should be carefully mixed by rubbing with the hand, the lumps being broken down and mixed as uniformly as possible with the powdery part. If this mixture be carefully made, a quantity of it not exceeding *two ounces* will suffice for the analysis. It should be folded up in tinfoil, to prevent its becoming dry, and is most cheaply and expeditiously forwarded by post. In default of tinfoil, the sample may be wrapped in double folds of strong writing-paper; and if the

paper be well rubbed with wax, so as to make it impervious to moisture, it will answer nearly as well. Should the manure contain stones, or be very moist, or should any difficulty be experienced in making a uniform mixture, it is desirable that *two or three pounds* should be sent.

Soils.—In selecting Soils for Analysis, five or six spadefuls should be taken from different parts of the field, and, after being spread out in a thin layer for several days to dry, should be put two or three times through a fine sieve, so as to insure uniform mixture. For a complete analysis, not less than *four pounds* should be sent; for a partial analysis, three or four ounces will be sufficient.

Waters.—For the complete analysis of a water, about *two gallons* are required; for the determination of the amount of salts in solution, and lime thrown down by boiling, *two quarts* will suffice. A well-water may be selected at any time; but the water of a spring or running stream should be taken in dry weather. The jars or bottles in which they are sent must be tightly corked and sealed. In the analysis of a mineral water, it may sometimes be desirable to determine the amount of gases held in solution, in which case certain precautions must be observed which require the presence of a Chemist at the spring.

Limestones, Clays, Ironstones, &c.—If the bed of any of these substances of which the analysis is required be very uniform in appearance, a piece of two or three ounces weight, taken from any part of it, will be enough for analysis; but in all cases it is better to send three or four chips from different parts of its thickness. Sometimes where the characters of different parts of the bed vary much, separate analyses of these portions may be requisite, in which case two ounces of each may be sent.

Every sample sent for analysis should be distinctly labelled, and marked with the name and address of the sender in full, mentioning also whether he is a Member of the Society; and in the case of imported manures, the name of the ship should, if possible, be stated. All samples should be accompanied by a letter, specifying the particular analysis required, according to its number in the foregoing list, and, if possible, the object in view, as, by doing so, much trouble and delay will occasionally be saved.

By order of the Directors,

J[N]. HALL MAXWELL, *Secretary.*

EDINBURGH, 6 ALBYN PLACE,
February 16th, 1860.

PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

1861.

PRINTED BY NEILL AND COMPANY, EDINBURGH

CONTENTS.

PRELIMINARY NOTICE.

WHEN the HIGHLAND SOCIETY was instituted in the year 1784, and established by Royal Charter in 1787, its objects, comparatively, were few, and their operation was limited to matters connected with the improvement of the Highlands of Scotland.

The patronage of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, or undertaken by other Associations, several of the earlier objects contemplated by the Society were consequently abandoned, while the progress of Agriculture led to the adoption of others of a more general character.

The exertions of the Society, instead of being restricted to the improvement of the Highlands, were early extended to that of the Lowlands, and have in both, for three-quarters of a century, been directed to the promotion of the science and practice of Agriculture, in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The leading purposes of the Institution are set forth in the following pages, where it will be found that Premiums are awarded for Reports on almost every subject connected with the cultivation of the soil: the rearing and feeding of stock; the management of the dairy; the growth of timber; the extension of cottage accommodation; the improvement of agricultural machinery and implements; and the dissemination of veterinary information.

Among the more important measures which have been effected by the Society, are,—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal Towns of Scotland, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A System of District Shows, instituted for the purpose of improving the Breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement and promotion of a proper system of Agricultural Education, by means of powers conferred by a Supplementary Royal Charter, authorizing "The COUNCIL of the HIGHLAND AND AGRICULTURAL SOCIETY on EDUCATION" to prescribe a curriculum of study, and to grant Diplomas to Students of Agriculture who shall pass the requisite examination (see p. 75).

4. The advancement of the Veterinary Art, by conferring the Society's diploma on Students who have passed through a prescribed curriculum, and who are found by a rigid examination qualified to practise.

5. The appointment of a Chemist for the purpose of promoting the application of science to Agriculture. Investigations on subjects of importance are conducted in the Laboratory, and published in the Transactions. Members can obtain Analyses, Reports, and advice on terms very much below those charged to others (see p. 77).

6. The establishment of an Agricultural Museum illustrative of the vegetable products of the country.

7. Monthly Meetings during the Winter Session for the discussion of Agricultural subjects.

8. The periodical publication of the Transactions, which comprehend the proceedings in the Laboratory, Reports of Experiments, and other communications addressed to the Society. The Transactions are published by Messrs BLACKWOOD and SONS, Edinburgh, along with the Quarterly Journal of Agriculture.

CONSTITUTION AND ESTABLISHMENT.

The general business of the HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of a Royal Charter, which authorizes the enactment of Bye-Laws. Business connected with Agricultural Education is conducted under the authority of a Supplementary Royal Charter, also authorizing the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Ten Extraordinary, and Thirty Ordinary Directors, a Treasurer, an Honorary and an Acting Secretary. The proceedings of the Directors are reported to Half-yearly General Meetings of the Society, held in January, and in June or July. The Council on Education, under the Supplementary Charter, consists of Sixteen Members—Nine nominated by the Charter, and Seven elected by the Society. The Board of Examiners consists of Twelve Members.

New Members are admitted at the General Meetings by Ballot. The ordinary subscription is £1, 3s. 6d. annually, which may be redeemed by one payment, varying, according to the number of previous annual payments, from £12, 12s. to £7, 1s. Tenant-Farmers, Secretaries and Treasurers of Local Agricultural Associations, Factors, and Proprietors farming the whole of their own lands, whose assessment in the Valuation Roll does not exceed £500, are admitted on a subscription of 10s. annually, or £5, 5s. for life.

Members of the Society are entitled to apply for District Premiums,—to report Ploughing Matches for the Medal,—to attend Shows and exhibit Stock free,—to consult the Chemist at reduced rates,—and to receive the Journal and Transactions at a modified price.

The Premiums awarded by the Society are payable after the 1st January for the preceding year. Premiums must be applied for at the Secretary's Office, and payment can only be made on production of the stamped receipt of the party entitled to it. Premiums not applied for within two years from the term of payment will be forfeited.

All communications are to be addressed to the Secretary of the Society, 6 ALBYN PLACE, EDINBURGH.

ESTABLISHMENT FOR 1861.

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Council on Education.

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to prescribe a Curriculum for Agricultural Education, and to grant Diplomas.

Members of Council named by Charter.

The DUKE OF ATHOLE, *President*. The LORD JUSTICE-GENERAL, *Vice-President*.

The LORD ADVOCATE.
The DEAN of FACULTY.
The PROFESSOR of AGRICULTURE.
The PROFESSOR of ANATOMY.
The PROFESSOR of BOTANY.
The PROFESSOR of CHEMISTRY.
The PROFESSOR of NATURAL HISTORY.

Members of Council named by Society.

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GEORGE HOPE, Fenton Barns.
JOHN MILLER of Leithen.
ROBERT RUSSELL, Pilmuir.
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Science and Practice of Agriculture—Mechanics, and Architecture of the Farm—Professor JOHN WILSON; GEORGE HOPE, Fenton Barns; ROBERT RUSSELL, Pilmuir, and JOHN WILSON, Edington Mains.

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Chemistry—Professor THOMAS ANDERSON.

Natural History—Professor ALLMAN.

Veterinary Surgery—Professor DICK.

Field Engineering and Surveying—JOHN MILLER of Leithen, C.E., and JAMES STIRLING, C.E.

Book-Keeping and Accounts—KENNETH MACKENZIE, Accountant, and PETER M'LAGAN of Pumpherston.

Museum,

GEORGE IV. BRIDGE, OPEN TO THE PUBLIC, FROM 11 TO 4 EVERY DAY, EXCEPT MONDAY.

PREMIUMS.

GENERAL REGULATIONS FOR COMPETITORS.

All Reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in Competition; they must bear a distinguishing motto, and be accompanied by a sealed letter similarly marked, containing the name and address of the Reporter; initials must not be used.

None of the sealed letters, except those belonging to reports found entitled to at least one-half of the Premium offered, will be opened without the Author's consent.

Reports for which a Premium, or one-half of it, has been awarded become the property of the Society, and cannot be published, in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to the Author if applied for within twelve months.

When a Report is unsatisfactory, the Society is not bound to award the whole, or any part of a premium.

All Reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each premium must be strictly fulfilled. General Essays, and Papers compiled from books, will not be rewarded. Weights and Measurements must be indicated by the imperial standards.

The decisions of the Board of Directors are final and conclusive as to all Premiums, whether offered for Reports, or at General or District Shows, and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

Reports on subjects not included in the Premium List will be received, and honorary rewards will be given, when merited.

CLASS I.

REPORTS.

SECTION 1. ON SUBJECTS CONNECTED WITH THE SCIENCE AND PRACTICE OF AGRICULTURE.

1. HIRING MARKETS.

1. For an approved Report on the best designed, the best managed, and the most useful Register for Farm Labourers in operation during the years 1861, 1862, and 1863. The Report shall specify the books used, the rules and regulations in force, the reference made to character, the names of masters and servants entered respectively as desiring servants or situations, and the number of masters and servants supplied during each of the above years, &c.—Twenty-five Sovereigns.

Reports to be lodged by 1st May 1864.

2. For an approved Report on the practical steps most successfully carried into operation for the regulation and improvement of any Hiring-Market held during the years 1861, 1862, and 1863,—taking into account the hours of opening and closing; the hours of arrival and departure of railway trains; the arrangements of the market, including the order, method, and locality of hiring; the nature of the registers in use; the extent to which they are employed; the facilities afforded by them for reference to character; the substitutes for drinking; the providing of temperance refreshments; the getting up and regulation of proper amusements for the people, &c.; the effect of the whole on the sobriety and morality of the people, and on lengthening the duration of service—Fifty Sovereigns.

Reports to be lodged by 1st May 1864.

2. COTTAGES.

For an approved Report on the best construction and arrangement, and on the most suitable fittings for Labourers' Cottages in different districts, and under different circumstances—The Gold Medal, or Ten Sovereigns.

The Report must state the principles which should regulate the character and extent of the accommodation most suitable for different

districts. The internal fittings, and arrangements for ventilation and cleanliness, must be described, and the applicability and expediency of all recent improvements must be considered.

The Report must be illustrated by drawings or plans, and must embrace specifications and estimates of cost.

Reports to be lodged by 1st November 1861.

3. AGRICULTURE OF BERWICKSHIRE AND ROXBURGHSHIRE.

For an approved Report on the Agriculture of Berwickshire and Roxburghshire—Twenty-five Sovereigns.

The Report should embrace full details of the different sytems of farm management observed in the district, and of the progress which Agriculture has made within the last 25 years.

Reports to be lodged by 1st November 1861.

4. AGRICULTURE OF ABERDEENSHIRE AND BANFFSHIRE.

For an approved Report on the Agriculture of Aberdeenshire and Banffshire—Twenty-five Sovereigns.

The Report should embrace full details of the different systems of farm management observed in the district, and of the progress which Agriculture has made within the last 25 years.

Reports to be lodged by 1st November 1862.

5. DEEP PLOUGHING.

For an approved Report on the comparative results obtained by the following modes of Ploughing:—*1st*, With a furrow not less than six inches; *2d*, With a furrow not less than ten inches; *3d*, By subsoiling—The Gold Medal, or Ten Sovereigns.

The land operated on must have been thoroughly drained. The description of Plough used in each operation, and its maker's name, must be given, and the value of the experiment will be enhanced were the same operation conducted with ploughs of different kinds. The Report must state the nature of the soil and subsoil, and the date, depth, and expense, of each ploughing. The extent of land to be not less than one acre for each mode of ploughing, and the produce to be weighed or measured. Except as regards ploughing, the whole land to be treated alike.

Reports to be lodged by 1st November 1861.

6. EFFECT OF SPECIAL MANURES OVER A ROTATION.

For an approved Report, to be made after a rotation, on the

comparative effects, immediate and continued, of different special Manures—Thirty Sovereigns.

As the object of the premium is to encourage experiments for determining the value of various applications, as regards not only increased quantity and improved quality of crops, but also the permanence of the different substances throughout the rotation, the Report must have reference to points such as specific gravity and quality of turnips—weights of grain, straw, and hay—effects on straw and hay for fodder, and such like. The results obtained from each application to be compared with those of the ordinary manuring of the farm. Each experiment to be conducted on not less than one rood of land, and the whole to be repeated in duplicate, and the exact composition of the special manures used must be given.

Reports to be lodged by 1st November 1861.

7. PHOSPHATIC AND AMMONIACAL MANURES.

For an approved Report on the different effects of Phosphatic manures and Ammoniacal manures when applied to the raising of early and late sown turnips—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

8. SOLUBLE AND INSOLUBLE PHOSPHATES.

For an approved Report on the comparative effects of manures containing insoluble Phosphates, such as bone-ash and coprolites, and the same substances in which the Phosphates have been rendered soluble by acids—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

9. SPECIAL MANURES AS SUBSTITUTES FOR GUANO.

For an approved Report of experiments conducted with a view of determining the comparative value of other substances, mixed or unmixed, as a substitute for Guano. The experiment to embrace at least two of the manufactured or saline manures, and to be made on turnips, grass, one or more of the cereal crops, and, if possible, on beans. Not less than half an acre to be allowed for each experiment, and the whole produce to be weighed or measured—Twenty Sovereigns.

Reports to be lodged by the 1st May 1862.

10. MANURES FOR PEAT MOSS.

For an approved Report on the best and most economical method of reclaiming and rendering productive Peat Moss,—and on the substances best adapted for fertilizing it—The Gold Medal, or Ten Sovereigns.

As it is frequently difficult to cart farm-yard manure on moss for some time after it has been drained, attention is particularly directed to the *portable* manures most efficacious in overcoming the inert properties of peat, and rendering it productive. The depth and composition of the moss experimented on—the method of improvement adopted—the nature of the drainage—the quantity of lime, clay, or other foreign substance applied—the period of application—the mode of constructing roads—the detailed expenditure, and the results obtained—must be stated.

Reports to be lodged by 1st November 1861.

11. MANURES PRODUCED BY DIFFERENT KINDS OF FEEDING.

For an approved Report of the result of experiments for ascertaining the comparative value of farm-yard manure, obtained from cattle fed upon different varieties of food, by the application of such manures to farm crops—Twenty Sovereigns.

The Report must state the effects produced on two successive crops by the application of manure obtained from cattle fed on different sorts of food, such as turnips and straw alone; and turnips and straw, with an addition of oil-cake, linseed, bean-meal, grain, or other substances. The animals should be as nearly as possible of the same age, weight, condition, and maturity, and each lot should receive daily the same quantity of litter; and, except as to the difference of food, they must be treated alike.

The preparation of the manure, by fermentation or otherwise, should be in every respect the same; and it is desirable that not less than two several experiments be made with each kind, and that the ground to which it is to be applied be as equal as possible in quality and condition.

Reports to be lodged by 1st May in any year.

12. MANURE MADE WITH AND WITHOUT COVER.

For an approved Report on the comparative value of Manure made in the ordinary manner, and of Manure kept under cover till applied to the land—Twenty Sovereigns.

The experiment may be conducted either with manure made in the open strawyard, contrasted with that made in covered hammels

or boxes, or with manure made in feeding-houses, part of which shall have been placed under cover, and part removed to the open dung-pit, and kept carefully unmixed with any other manure. Preference will be given to experiments embracing both of these modes. The cattle must be fed and littered alike. There must be at least an acre of land experimented on with each sort of manure—the different lots must be manured to the same extent, and be equal in soil; on two separate portions of each, not less than 20 poles, the crops must be accurately weighed and measured. The result, as given by two successive crops, to be reported.

Reports to be lodged by 1st May in any year.

13. DISINFECTANTS.

For an approved Report on the action of Disinfectants on the manure of stables and byres, with reference to the health of the animals, and the value of the manure—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

14. SHELL AND CORAL SAND.

For an approved Report on the application of Shell or of Coral Sand as a fertilizer—The Gold Medal, or Ten Sovereigns.

The Report must state the quantity of shell or coral sand available in a district, its composition, the best mode of applying it, the expense of the application, and the results obtained, as compared with those of an experiment with the same crop in similar land without the application. The price at which the sand can be purchased, and the facilities for exporting it, to be stated.

Competitors to send samples of the sand experimented with to Dr Anderson.

Reports to be lodged by 1st November 1861.

15. TOP-DRESSING FOR PASTURE.

For an approved Report on the substances which may be most profitably employed in Top-dressing Pasture—The Gold Medal, or Ten Sovereigns.

The Report, which has reference to land not in hay but in pasture, must state the nature of the substances used, the time and cost of the application, and the comparative results, which must be contrasted with those obtained from a portion of the same field to which no top-dressing was applied.

The substances *recommended* for trial are bones, bone-ash, guano,

nitrate of soda, sulphate of ammonia, superphosphate of lime, sulphate of potash, and muriate of potash; but competitors are not restricted to these or any other substances.

Reports to be lodged by 1st November 1861.

16. AUTUMN MANURING.

For an approved Report on the comparative advantages of applying Manure to the stubble in Autumn, or in the drills in Spring for turnips, potatoes, or beans—Twenty Sovereigns.

The experiment must extend over three years, and comprise,—1*st*, the green crop; 2*d*, the grain crop; 3*d*, the clover crop. It must be conducted on not less than four acres—one-half of which shall be dunged in autumn, and the other in spring, with equal weights of manure, made as nearly as possible in the same way, and from animals fed on substances of equivalent nutritive values. The quantities and kinds of special manures applied at any period of the rotation must be the same on each lot, and must be stated. The treatment and condition of the land prior to the experiment must be mentioned.

As the object of this premium is to determine the comparative advantages of autumn manuring, there will be no restriction as to labouring the land, but the Reporter must state how that was done on each lot during the experiment.

Reports to be lodged by 1st November 1861.

17. IMPROVED VARIETIES OF AGRICULTURAL PLANTS.

For an approved Report on the means successfully employed for obtaining new and superior varieties, or improved sub-varieties, of any of the cereal grains, grasses, roots, or other agricultural plants —The Gold Medal, or Ten Sovereigns.

It is necessary that the varieties and sub-varieties reported upon shall have been proved capable of reproduction from seed, and also that the relation they bear to others, or well-known sorts, should be stated. The Reporter is further requested to mention the effects that he may have observed produced by different soils, manures, &c., on the plants forming the subjects of reports, and how far he may have ascertained such effects to be lasting.

Should any improved variety reported upon be the result of direct experiment by cross impregnation, involving expense and long-continued attention, a higher premium will be awarded.

Reports to be lodged by 1st November 1861.

18. DIFFERENT KINDS OF WHEAT.

For an approved Report of experiments conducted for the purpose of determining the relative productiveness in corn and straw of Hunter's, Hopetoun, Fenton, and any other variety of White Wheat—Twenty Sovereigns.

The Experiment must embrace crops 1862 and 1863. Intention to compete must be intimated to the Secretary not later than 1st January 1862. The soil shall be uniform in quality and condition. One acre must be allowed for each kind of wheat, and the lots must be separated by spaces not less than two feet wide. Care must be taken to select true samples of seed for crop 1862, the produce of which shall be used as seed in 1863. Samples of the original seed, and of each year's crop, to be lodged with the Report. The wheats to be sown, by drill or broadcast, not later than November, and the crops shall be inspected by a committee in May and July following. The whole produce shall be weighed and measured; and care must be taken thoroughly to cleanse the thrashing-machine previous to testing each variety. The Report shall further specify the quantity of each variety of seed sown—where it was obtained—the dates of sowing, brairding, earing, ripening—the properties and appearances of the crops when growing—and the produce each year in corn and straw.

Reports to be lodged by 1st November 1863.

19. DIFFERENT KINDS OF OATS.

For an approved Report of experiments conducted for the purpose of determining the relative productiveness in corn and straw of not fewer than four varieties of Oats—Fifteen Sovereigns.

The Experiment must embrace crops 1861 and 1862. Intention to compete must be intimated to the Secretary not later than 1st May 1861. The soil shall be uniform in quality and condition. One acre must be allowed for each variety, and the lots must be separated by spaces not less than two feet wide. Care must be taken to select true samples of seed for crop 1861, the produce of which shall be used as seed in 1862. Samples of the original seed, and of each year's crop, to be lodged with the Report. The oats may be sown, by drill or broadcast, and the crops shall be inspected by a committee in June and July following. The whole produce shall be weighed and measured; and care must be taken thoroughly to cleanse the thrashing-machine previous to testing each variety. The Report shall further specify the quantity of each variety of seed sown—where it was obtained—the dates of sowing, brairding, earing, ripening—the properties and appear-

ances of the crops when growing—and the produce each year in corn and straw.

Reports to be lodged by 1st November 1862.

20. INTERMEDIATE CROP OF TURNIP, RAPE, &c.

For an approved Report on the best mode of cropping land with an intermediate crop of Turnip, Rape, &c., when a white crop is intended to follow an early lifted crop of Potatoes—The Medium Gold Medal, or Five Sovereigns.

The Report must show the effect on the after white crop, as compared with the results on a part of the same land from which no intermediate crop shall be taken.

Reports to be lodged by 1st November 1861.

21. COMPARATIVE PRODUCTIVENESS, &c., OF POTATOES.

For an approved Report on the comparative productiveness, and general qualities for use and keeping, of the different kinds of Potatoes used in field culture, and the results observable on the white crops following different varieties of Potatoes—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st May 1862.

22. COMPARATIVE PRODUCTIVENESS, &c., OF TURNIPS.

For an approved Report of the comparative productiveness, and general qualities for use, and keeping, of the different kinds of Swedish, Yellow, and White Turnips, generally used in field culture, and the results observable on the white crops following different varieties—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st May 1862.

23. MANGOLD-WURZEL.

For an approved Report on the cultivation of Mangold-Wurzel in Scotland—The Medium Gold Medal, or Five Sovereigns.

The Reporter must state the nature and previous preparation of the soil—the varieties grown—the period of sowing—the quantity of seed per acre, and mode of sowing—the time and mode of thinning and cleaning—the best means of preventing seeding—the time and manner of storing—the crop obtained—and its comparative value for feeding purposes.

Reports to be lodged by 1st May 1862.

24. CARROTS.

For an approved Report on the cultivation of the Carrot as a field crop—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st May 1862.

25. CABBAGE.

For an approved Report on the cultivation of the Cabbage as a field crop—The Medium Gold Medal, or Five Sovereigns.

The experiment must be conducted on not less than one acre, and contrasted with a like extent under turnips in the same field. Both lots must have been under one rotation, and must be prepared and manured in the same manner.

Reports to be lodged by 1st May 1862.

26. GRASS WITH OR WITHOUT A WHITE CROP.

For an approved Report on the comparative advantages of sowing down for Pasture, with or without a cereal crop. The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

27. VEGETABLE PRODUCTIONS OF INDIA, CHINA, AMERICA, &c.

For an approved Report on the hardy and useful Herbaceous Plants, including Grains and Grasses of China, Japan, the Islands of the Eastern Archipelago, the Himalaya Country, the Falkland and South Sea Islands, California, the high north-western districts of America, or any other country where such climate exists as to induce the belief that the plants may be beneficially introduced into the cultivation of Scotland—The Gold Medal, or Ten Sovereigns.

Reporters are required to give the generic and specific names of the plants treated of, with the authority for the same—together with the native names, in so far as known; and to state the elevation of the locality and nature of the soil in which they are cultivated, or which they naturally inhabit, with their qualities or uses; and it is further requested that the descriptions be accompanied, in so far as possible, with specimens of the plants, and their fruit, seed, or other products.

Reports to be lodged by 1st November in any year.

FEEDING STOCK.

The experiments specified in Nos. 28, 29, 30, and 31, must be conducted over a period of not less than three months. No lot shall consist of fewer than four Cattle or five Sheep. The animals selected should be of the same age, sex, and breed, and as nearly as possible, of the same weight, condition, and maturity. Their live weight before and after the experiment must be stated, and, if killed, their dead weight and quantity of tallow.

28. BEST MODES OF HOUSING FATTENING CATTLE.

For an approved Report on the comparative advantages of fattening Cattle in stalls, in loose houses or boxes, and in sheds or hammels—Twenty Sovereigns.

The Report must detail the comparative result of actual experiments. The same quantities and kinds of food shall be used. Information is required as to the comparative expense of attendance, the cost of erecting the buildings, and any other circumstances deserving of attention. The state of the weather during the experiment in point of temperature and wetness must be particularly noted and reported.

Reports to be lodged by 1st May 1862.

29. DIFFERENT DESCRIPTIONS OF FOOD.

For an approved Report of experiments for ascertaining the actual addition of weight to growing or fattening stock, by the use of different kinds of Food—Twenty Sovereigns.

The attention of the experimenter is directed to turnips, carrots, beet, mangold-wurzel, potatoes, cabbage, as well as to beans, oats, barley, Indian corn, linseed, oil-cake, or rape-cake, and to the effect of warmth and proper ventilation, and the difference between food cooked and raw. The above roots and other kinds of food are merely suggested; Competitors are neither restricted to them, nor obliged to experiment on all of them.

When experiments are made with linseed and cake, attention should be paid to the comparative advantages, economically and otherwise, of the substances in these two states.

Before commencing the comparative experiments, the animals must be fed equally for sometime previously.

The progress of different breeds may be compared; this will form

an interesting experiment of itself, for Reports of which encouragement will be given.

Reports to be lodged by 1st May 1862.

30. COMPARATIVE FEEDING QUALITIES OF LINSEED-CAKE AND RAPE-CAKE.

For an approved Report on the comparative feeding qualities of Linseed-Cake and of Rape-Cake, to be ascertained by feeding two lots of Cattle on each of these substances, with or without Turnips, or other ordinary food, equal quantities of the two cakes being given— The Gold Medal or Ten Sovereigns.

Reports to be lodged by 1st May 1862.

31. COMPARATIVE FATTENING QUALITIES OF PURE AND CROSS-BRED SHEEP.

For an approved Report of experiments for determining the comparative fattening qualities of pure and cross-bred Sheep— The Gold Medal, or Ten Sovereigns.

One lot must consist of any pure breed, the other of any cross between that and another breed. The same descriptions of food must be given; the quantities consumed, and the increase in the weight and value of each lot must be carefully noted.

Reports to be lodged by 1st May 1862.

32. DISEASES OF SHEEP FED ON TURNIPS.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post mortem* appearances, of the Diseases to which Sheep are subject when fed on Turnips, and on the conditions of soil and management under which such Diseases are most apt to manifest themselves—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1862.

33. JOINT-ILL IN CATTLE AND SHEEP.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment of Joint-Ill in Cattle and Sheep —The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

34. PARALYSIS IN LAMBS.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment of Paralysis in Lambs—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1861.

35. RURAL ECONOMY ABROAD.

For an approved Report, founded on personal observation, of any useful practice, in Rural or Domestic Economy, adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal.

The purpose chiefly contemplated by the offer of this premium is to induce gentlemen who may visit other countries to notice and record such particular practices as may seem calculated to benefit their own country.

Reports to be lodged by 1st November in any year.

SECTION 2. WOODS AND PLANTATIONS.

1. EXTENSIVE PLANTING.

For an approved Report by a Proprietor who shall, within the five preceding years, have planted the greatest extent of ground, not being less than 150 acres. The whole planting operations that may have been conducted by the Reporter within the five years, whether completed or not, must be embraced, and he must state the expense—description of soil—age, kind, and number of trees planted per acre—mode of planting, draining, and fencing—and general state of the plantation—and any other observations of interest—The Gold Medal.

Reports to be lodged by 1st November in any year.

2. FORMATION AND MANAGEMENT OF YOUNG PLANTATIONS.

For an approved Report of Plantations formed within a period of not more than ten, nor less than five years preceding the date of the Report—The Gold Medal, or Ten Sovereigns.

The Report should comprehend every interesting particular; among

others, the exposure, altitude, and general climate of the locality—the character and condition of the soil and subsoil—a detailed statement of the expense, including that of enclosing, draining, and fencing, and a specification of the manner in which these operations were performed—the mode of planting adopted—the prevailing weather while planting, and for a month after the operation—the kind of trees planted, and the number of each kind per acre—their relative progress—the proportion of blanks and deaths at the end of three years—the system of management—the state of the plantations at the date of making the Report—and any other observation of interest.

Reports to be lodged by 1st November in any year.

3. GENERAL MANAGEMENT OF PLANTATIONS.

For an approved Report of the management of Plantations, from the commencement of the first thinning till the period of yielding full-grown timber—The Gold Medal, or Ten Sovereigns.

The Report should embrace the following points:—The annual progress of the different sorts of trees—the effects of altitude and exposure—the general advantages of shelter—the mode of thinning and pruning adopted—the uses and value of the thinnings—the plan of registry and of valuing, or a specimen of the method in which the forester's book is kept—the valuation at the time of the Report—together with such general remarks as may be thought useful.

The Report is not expected to embrace the formation and early management, further than the description of soil, kinds of plants, whether mixed or in masses, together with a note of the expense from the time of planting to the commencement of the first thinning, in so far as such information is in the possession of the Reporter.

Reports to be lodged by 1st November in any year.

4. USES AND VALUE OF TIMBER.

For an approved Report on the economic uses and comparative value of different descriptions of Timber grown in Scotland—The Gold Medal, or Ten Sovereigns.

This premium may be regarded as a sequence to Nos. 2 and 3; the object being to obtain the practical and economic results of forming and of managing woods, by ascertaining the purposes to which

they have been applied, and the pecuniary returns they have yielded.

The Reporter, besides stating the actual results of his own observation and experience, should indicate the objects which planters ought to have in view with reference to profitable return, by stating the kinds of trees that should be planted—the periods at which they should be cut—the purposes to which they should be applied—and the returns that may be looked for, in different localities, and under different circumstances.

There must be a general description of the management, soil, altitude, exposure, &c., of the particular woods reported on, and attention is directed to the difference supposed to exist in the quality of natural and planted timber.

Reports to be lodged by 1st November in any year.

5. MIXED AND UNMIXED PLANTATIONS.

For an approved Report on mixed and unmixed Plantations—The Medium Gold Medal, or Five Sovereigns.

As wood in a state of natural growth, both at home and abroad, is generally found unmixed, each variety occupying the soil or situation best adapted to its growth, the idea of planting on a mapped system is suggested. The Reporter will state his experience in grouping plantations—his opinion of the advantages of the system compared with mixed planting—and the soils and situations and exposures most suitable for different kinds of hard and soft wood.

Reports to be lodged by 1st November in any year.

6. COMPARATIVE QUALITIES OF SCOTCH, AUSTRIAN, AND CORSICAN FIR.

For an approved Report on the comparative value, for economical purposes, of the Scotch, Austrian, and Corsican Fir, and on their adaptation to different soils and situations—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st November in any year.

7. PLANTING WITHIN THE INFLUENCE OF THE SEA OR ON BARREN TRACTS.

For an approved Report on successful planting within the in-

fluence of the sea, or on exposed sterile tracts, founded on observation of the habits and appearance of the different sort of trees considered best suited for such situations—The Gold Medal, or Ten Sovereigns.

The plantations reported on must not be less than ten years old.

Information is particularly desired regarding the species and varieties of trees calculated for growing in situations unfavourable to most of those generally cultivated, as bleak heaths, sandy links, exposed maritime situations, and high northern exposures.

The Reporter must specify the extent of planting and mode of drainage and fencing—the nature of the soil and subsoil—the elevation and exposure of the locality—its distance from the sea; and—if in his power, he should notice the underlying rocks, and the geological features of the district.

Reports to be lodged by 1st November in any year.

8. ARBORETUM.

For an approved Report on the most varied, extensive, and judiciously arranged collections of forest and ornamental trees, either *species* or marked *varieties*, of not less than eight years' standing in Scotland—The Gold Medal, or Ten Sovereigns.

The Arboretum must be formed so as to afford ample space for the full development of the specimens. The report must specify the nature of the locality—its altitude and exposure—the description and previous preparation of the soil—the date of planting—the system of draining—fencing—and pruning—and any other circumstances which may be supposed to influence the growth of the plants; the number of failures, with the periods when, and circumstances under which, these occurred, must also be reported. Information should be added, when in the Reporter's possession, as to the age and average height of the specimens—whether they are seedlings, cuttings, layers, or grafted plants—and, if possible, the stock on which they have been grafted.

The Report must be accompanied with a correct list, containing the names of the different species and varieties, with an authority for each, and a plan showing the disposition of each specimen. The trees in the Arboretum must be numbered and named relative to the list and plan.

Reports to be lodged by 1st November in any year.

9. PRUNING CONIFERÆ.

For an approved Report on the pruning of the rarer Coniferæ— The Medium Gold Medal, or Five Sovereigns.

The Reporter must consider the propriety of pruning Coniferæ as a general question, and the effects produced by pruning and by non-pruning. He will state the kinds of Coniferæ best adapted for pruning, and the period of the year, the age of the tree, and the circumstances under which it should be done; he will also report on the comparative effects of pointing and pruning, and the best method of pointing when that system is adopted.

Reports to be lodged by 1st November in any year.

10. DISEASES OF FOREST TREES.

For an approved Report on the diseases incidental to forest trees, and the injuries they sustain from the attacks of Insects— The Gold Medal, or Ten Sovereigns.

The Report must state the kinds of trees most generally liable to attack—the parts first affected—the age of the tree and period of the season when first observed—the state of the drainage—the altitude and exposure of the locality, and its geological formation —the nature of the soil and subsoil—when and how the trees were pruned—the remedies, preventive and remedial, which may have been tried. Information is required as to the causes of decay—whether attacks of insects, or cryptogamic growth—and how far either of these causes may have been induced by the previous sickly or stunted condition of the tree. Attention is particularly directed to the Larch, Silver Fir, and White Pine (*Pinus Strobus*), and to the Coniferæ generally, and particularly to the stripping the leaves from Scotch and other pines by the pine-leaf caterpillar.

Reports to be lodged by 1st November in any year.

11. PLANTING PEAT MOSS.

For an approved Report on Plantations, of not less than eight years' standing, formed on deep peat moss—The Medium Gold Medal, or Five Sovereigns.

It being understood that large tracts of peat moss have been profitably planted in England and Holland, it is considered desirable to

obtain information on the subject. The Premium is strictly applicable to deep peat or flow moss; the condition of the moss in its original state, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

Reports to be lodged by 1st November in any year.

12. WILLOWS.

For an approved Report on the cultivation of Willows, and their most advantageous employment for basket and other industrial purposes—The Medium Gold Medal, or Five Sovereigns.

The Report must state the nature of the soil and subsoil—the time and mode of planting—the expense per acre—the best varieties—and the most profitable applications.

Reports to be lodged by 1st November 1861.

13. FOREST TREES OF RECENT INTRODUCTION.

For an approved Report on the more extended introduction of hardy, useful, or ornamental trees, which have not hitherto been generally cultivated in Scotland—The Medium Gold Medal, or Five Sovereigns.

The Report should specify, as distinctly as possible, the kind of trees introduced. The nature of the plantation should likewise be described, as to soil, exposure, shelter, and elevation above the level of the sea. The adaptation of the trees for use or ornament, and their comparative progress, should be mentioned. Attention is directed to the introduction into use of any tree as a nurse in young plantations, which, by growing rapidly for several years, and attaining maturity when at the height of 20 or 25 feet, might realize the advantages and avoid the evils of thick planting.

Reports to be lodged by 1st November in any year.

14. IMPORTATION OF SEEDS.

To the person who shall send to the Society seeds capable of germination, either of new or recently-introduced Coniferæ, or of the rarer kinds of forest trees—The Medium Gold Medal.

Before the Premium is awarded, the number of seedling plants of each species raised by the Society shall not have been less than 50. Seeds of Coniferæ may be sent home in the cones, wrapped in brown paper, packed in a box, to be kept in a cool, airy part of the cabin, but on no account in the hold, nor in close tin cases. Hasty and severe heating in extracting seeds from the cone should be carefully avoided. Seeds of hardwood may be packed in brown paper, or in sphagnum (moss), or they may be mixed with soil and placed in strong boxes.

Seeds may be forwarded at any time.

15. GROWTH OF RECENTLY INTRODUCED CONIFERÆ.

With the view of ascertaining the progress of Coniferæ introduced within the last 30 years, and the most suitable relations of soil, altitude, exposure, &c., Members of the Society and others are requested to forward, in the subjoined form, whatever information they can afford, with the view to its being tabulated and published. The following trees may be reported on:—

Araucaria imbricata, Cedrus Deodara, Abies Douglassi, A. Menziesii, A. Morinda, Picea nobilis, P. cephalonica, P. Pinsapo, Pinus Laricio, P. excelsa, P. Lambertiana, P. monticola, P. ponderosa, Cupressus torulosa, P. macrocarpa.

Name of Tree.	Seedling or Transplanted.	Where Seed or Plant got.	Age.	Size.	Soil.	Subsoil.	Altitude.	Exposure.	Present Condition.	Where growing.	General Remarks.

16. ROOTS OF CONIFERÆ.

For an approved Report of experiments on the uses to which the fibrous parts of the roots of Coniferous Trees may be applied—The Medium Gold Medal, or Five Sovereigns.

In North-West America, the fibrous parts of the roots of some of

the Coniferous trees are extensively employed for purposes similar to those to which willows are applied in this country, more particularly when the wood has been grown in soft peaty soils. The object of the premium is to elicit information regarding the possibility of profitably extracting, and applying to economic purposes the vast quantities of roots left in the ground.

Reports to be lodged by 1st November in any year.

17. EFFECT OF FROST.

For an approved Report on the effect on Trees and Shrubs, of all descriptions and ages, of the severe frost experienced in December and January.—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st November 1861.

SECTION 3. LAND IMPROVEMENTS.

1. GENERAL IMPROVEMENT OF ESTATES.

To the Proprietor who shall report the most judicious, successful, and extensive improvement of an Estate—The Gold Medal, or Ten Sovereigns.

The merits of the Report will not be determined so much by the mere extent of the improvements as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

Reports to be lodged by 1st May in any year.

2. RECLAMATION OF WASTE LAND BY TILLAGE.

1. For an approved Report by a Proprietor or Tenant of the reclaiming, within the six preceding years, of not less than fifty acres of Waste Land—The Gold Medal, or Ten Sovereigns.

2. For an approved Report by a Tenant of the reclaiming, within the four preceding years, of not less than twenty acres of Waste Land—The Medium Gold Medal, or Five Sovereigns.

3. For a similar Report by a Tenant of the reclaiming of not less than ten acres—The Silver Medal.

The Reports may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the land reclaimed—to the nature of the soil—the previous state and probable value of the subject — the obstacles opposed to its improvement — the details of the various operations—the mode of cultivation adopted —and the produce and value of the crops produced. As the required extent cannot consist of different patches of land, the improvement must have relation to one subject, it must be of a profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return*, and a certified measurement of the ground are requisite.

Reports to be lodged by 1st May in any year.

3. IMPROVEMENT OF WASTE LAND WITHOUT TILLAGE.

1. For an approved Report of the improvement, within the three preceding years, of the pasturage of not less than thirty acres, by means of Top-Dressing, Draining, or otherwise without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns.

2. For an approved Report of a similar improvement of not less than ten acres—The Silver Medal.

Reports must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

Reports to be lodged by 1st May in any year.

SECTION 4. AGRICULTURAL MACHINERY.

1. INVENTION OR IMPROVEMENT OF IMPLEMENTS OF HUSBANDRY.

For approved Reports of such inventions or improvements, by the Reporters, of any Agricultural Implement or Machine as shall

be deemed by the Society of public utility—Medals, or sums not exceeding, in all, Fifty Sovereigns.

Reports may be lodged with the Secretary at any time, and should be accompanied by drawings and descriptions of the implement or machine, and, if necessary, by a model.

2. BEST CONSTRUCTION OF PLOUGH.

For an approved Report on different descriptions of Ploughs for different purposes—The Gold Medal, or Ten Sovereigns.

The attention of Competitors is particularly called to the importance of obtaining increase of depth with the least possible increase of draught. The Reporter must consider the merits of Swing-Ploughs, as compared with English Wheel-Ploughs; and the comparative advantages of the Scotch Ploughs, which give a high crested shoulder, and which give a rectangular shoulder. The best description of Subsoil and Trench Ploughs may also be adverted to.

Reports to be lodged by 1st November 1861.

CLASS II.

DISTRICT COMPETITIONS.

(Grants in aid of District Competitions for 1862 *must be applied for before* 1*st December next.)*

SECTION 1. CATTLE.

DISTRICTS.

1. *The District of the Border Union Society.*
2. *The District of Lorn.*
3. *The District of the Mar Association.*
4. *The Districts of Kintail, Lochalsh, and Applecross.*
5. *The County of Ayr.*
6. *The County of Renfrew.*
7. *The County of Stirling.*
8. *The County of Inverness.*
9. *The District of the Strathbogie Club.*
10. *The County of Elgin.*
11. *The District of the Spey, Avon, and Fiddochside Society.*
12. *The County of Peebles.*
13. *The District of Cowal.*
14. *The District of the Royal Northern Society.*
15. *The District of the Deeside Association.*
16. *The County of Fife.*
17. *The District of the Clackmannanshire Society.*
18. *The District of the Auchterarder Society.*
19. *The District of the Perth, Fife, Kinross, and Clackmannan Association.*

Conveners of Committees.

FIRST DISTRICT—Lord Polwarth.
SECOND DISTRICT—Dugald Macdougall of Gallanach.
THIRD DISTRICT—Archibald Grant of Tillyfour.
FOURTH DISTRICT—Alexander Matheson of Ardross, M.P.
FIFTH DISTRICT—Sir James Fergusson, Bart., M.P.
SIXTH DISTRICT—Lieut.-Col. Mure of Caldwell.
SEVENTH DISTRICT—J. Arch. Shaw Stewart, Carnock.
EIGHTH DISTRICT—Æneas W. Mackintosh of Raigmore.

NINTH DISTRICT—Robert Simpson of Cobairdy.
TENTH DISTRICT—Robert Grant of Kincorth.
ELEVENTH DISTRICT—James Skinner, Drumin.
TWELFTH DISTRICT—Sir Graham Graham Montgomery, Bart., M.P.
THIRTEENTH DISTRICT—Alexander S. Finlay of Castle Toward, M.P.
FOURTEENTH DISTRICT—Alexander Thomson of Banchory.
FIFTEENTH DISTRICT—Sir James H. Burnett, Bart.
SIXTEENTH DISTRICT—Alexander Bethune of Blebo.
SEVENTEENTH DISTRICT—James Johnstone of Alva.
EIGHTEENTH DISTRICT—Viscount Strathallan.
NINETEENTH DISTRICT—Lord Kinnaird, K.T.

PREMIUMS.

1. For the best Bull, of any pure Breed, not exceeding eight years old, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Bull, of any pure Breed, calved before 1st January 1859, and not exceeding eight years old, belonging to a Tenant, or Proprietor farming the whole of his own lands, ... £8
3. For the second best, ... £4
4. For the best Bull, of any pure Breed, calved after 1st January 1859, belonging to a Tenant, or Proprietor farming the whole of his own lands, . . £5
5. For the best pair of Heifers, of any pure Breed, of two years old (if Highland breed three years), belonging to a Tenant, or a Proprietor farming the whole of his own lands, ... £5
6. For the second best, ... £3

The Society's Premiums are granted to each district for three alternate years, on condition that the District shall, in the two intermediate years, continue the Competitions by offering for the same description of stock a sum not less than one-half of that given by the Society.

At the Intermediate Competitions, a Silver Medal will be placed at the disposal of the Committee to be awarded to the best lot exhibited.

In 1861,
No. 1 is in competition for the last year.
Nos. 2, 3, and 4, for the second year.
Nos. 5, 6, 7, 8, and 9, for the first year.

Nos. 10, 11, 12, 13, 14, and 15, compete for local premiums.
Nos. 16, 17, 18, and 19, are in abeyance on account of the Perth Show.

RULES OF COMPETITION.

1. The Members of the Society connected with the respective Districts are appointed Committees of superintendence for regulating the Competitions; five members to be a quorum.

2. The Convener of each district shall summon a Meeting of Committee, for the purpose of determining the time and place of Competition, the nomination of Judges, and other preliminary arrangements. The time and place shall be publicly intimated by Conveners, in such a manner as may appear to them most effectual.

3. The Competitions must take place before the 1st of November. The animals exhibited must belong to one of the following pure breeds:—Shorthorn—Ayrshire—Polled (Galloway, Angus, or Aberdeen)—Highland. The Bulls may be of one Breed, and the Heifers of another. The Committee shall select the Breed, and specify it in the returns.

4. Stock of an inferior description, or which does not fall within the prescribed regulations, shall not be placed for Competition. The Premiums shall not be divided. *No Money Premium shall be adjudged unless there are three lots exhibited, and not more than one-half unless there are six.* A Competitor may exhibit two Lots in each class. For the Medal, two Lots authorise an award.

5. An animal which has gained the Society's first Premium at a previous District or General Show is inadmissible in the same class, except for the Medal; and one which has gained a second Money Premium can only thereafter compete in that class for the first.

6. A Tenant may compete with Proprietors and Factors for the Medal with a Bull which has gained the first Money Premium at a previous Show. When there is any doubt as to whether a Competitor should be ranked as a Proprietor or a Tenant, the point is left to the decision of the Local Committee. Factors can only compete for the Medal.

7. A Bull, the property of two or more Tenants, may compete, although the Exhibitors may not be joint tenants. Bulls not belonging to the District may compete, provided they are left within it for service.

8. Bulls for which the Money Premiums are awarded must serve in the District at least one season; the rate of service may be fixed by the Committee.

9. Should it be proved that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Committee or Judges as to its qualification or properties, the case shall be reported to the Directors, to be dealt with by them in terms of Regulation No. 13 for General Shows.

10. If an animal has been disqualified on any previous occasion, such disqualification shall attach unless communicated to the Committee, in terms of Regulation No. 14 for General Shows.

11. Blank Reports and Returns will be furnished to the Conveners of the different Districts. These must, in all details, be completed and lodged with the Secretary on or before the 15th of November next.

12. A Report of the Competition and Premiums awarded at the *intermediate* Local Shows, in the several Districts, signed by a member of the Society, must

be transmitted to the Secretary on or before the 15th of November in each year, otherwise the Society's grant shall terminate.

13. It is to be distinctly understood, that in no instance does any claim lie against the Society for expenses attending a Show of Stock, beyond the amount of the Premiums offered; and that all Premiums not applied for within two years from the term of Payment (1st January 1862) shall be forfeited.

SECTION 2. DRAUGHT HORSES.

DISTRICTS.

1. *The County of Caithness.*
2. *The County of Kincardine.*
3. *The District in connection with the Perth, Fife, Kinross, and Clackmannan Association.*
4. *The Stewartry of Kirkcudbright.*
5. *The District of Machars in Wigtownshire.*

Conveners of Committees.

FIRST DISTRICT—Alexander Henderson of Stemster.
SECOND DISTRICT—Sir Thomas Gladstone, Bart.
THIRD DISTRICT—Lord Kinnaird, K.T.
FOURTH DISTRICT—James Mackie of Bargaly, M.P.
FIFTH DISTRICT—R. Vans Agnew of Barnbarroch.

Forty Sovereigns (of which ten are contributed by the Local Associations) will be awarded as follows :—

1. For the best Stallion, for agricultural purposes, not under three years and nine months, and not above twelve years old, £25
2. For the best Brood Mare, for agricultural purposes, . £10
3. For the best Filly, foaled after 1st January 1859, . £5

In 1861,

Nos. 1, and 2, are in competition for the last year.
Nos. 3, 4, and 5, for the first year.

RULES OF COMPETITION.

1. The Members of the Society in the District are appointed a Committee of Superintendence. They shall be convened in the manner and for the purposes prescribed by Nos. 1 and 2 of the Regulations for Cattle Competition.

2. The Competition for Stallions, and that for Mares and Fillies, may be held at different periods.

3. If fewer than three animals be exhibited in any class, half the Premium only can be awarded. The Regulations for Cattle Shows, regarding previous intimation to the Committee and Competitors—the exclusion of stock, if of inferior character—reporting false entries—extra expenses —the period within which Premiums must be applied for—and the manner in which the Reports

are to be certified and transmitted to the Society—are severally applicable to the Premiums for Horses. Evidence must be produced that the Prize Stallions have had produce. Mares must have foals at their feet, or be entered as being in foal; in the latter case, payment of the Premium will be deferred till certificate of birth.

ENTIRE COLTS.

The Society being anxious to promote the improvement of Draught Horses by encouraging the rearing of Entire Colts, Stallion premiums are limited to a period of two years, and followed by premiums for other two years within the same district for Entire Colts.

DISTRICTS.

1. *The County of Stirling.*
2. *The County of Forfar.*
3. *The Island of Bute.*
4. *The District of Rhins in Wigtownshire.*

Conveners of Committees.

FIRST DISTRICT—John Stirling of Kippendavie.
SECOND DISTRICT—Sir John Ogilvy, Bart., M.P.
THIRD DISTRICT—Thos. Gibson of Spittal.
FOURTH DISTRICT—George Guthrie, Rephad.

1. For the best Entire Colt, for agricultural purposes, foaled after 1st January 1859, ... £6
2. For the best Entire Colt, for agricultural purposes, foaled after 1st January 1860, . . . £4

If fewer than three animals are exhibited in either class, only half the Premium can be awarded. The other regulations for Horses are generally applicable.

In 1861,

Nos. 1, 2, 3, and 4, compete for the first year.

SECTION 3. SHEEP.

1. LEICESTER BREED.

DISTRICTS.

1. *The District of Lauderdale.*
2. *The District of the Melrose Farmers' Society.*
3. *The County of Forfar.*
4. *The County of Haddington.*
5. *The District of the Perth, Fife, Kinross and Clackmannan Society.*

Conveners of Committees

FIRST DISTRICT—William Fairholme of Chapel.
SECOND DISTRICT—Nicol Milne of Faldonside.
THIRD DISTRICT—Colonel Kinloch of Kilrie.
FOURTH DISTRICT—James W. Hunter of Thurston.
FIFTH DISTRICT—Lord Kinnaird, K.T.

1. For the best Tup, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age, . . . £5
3. For the best two Shearling Tups, . . . £5
4. For the best Pen of five Ewes, not less than two Shear, £5
5. For the best Pen of five Gimmers or Shearling Ewes, . £4

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own lands.

In 1861,

Nos. 1 and 2 are in competition for an extra year.

Nos. 3 and 4 compete for local Premiums.
No. 5 is in abeyance on account of the Perth Show.

2 CHEVIOT BREED.

DISTRICTS.

1. *The Districts of Mull and Morven.*
2. *The Districts of Gairloch and Lochbroom.*
3. *The District of Nithsdale.*
4. *The District of Annandale.*
5. *The Districts of Eskdale and Liddesdale.*
6. *The County of Selkirk.*
7. *The Islands of Islay, Jura, and Colonsay.*

Conveners of Committees.

FIRST DISTRICT—Farquhar Campbell of Aros.
SECOND DISTRICT—Sir Kenneth S. Mackenzie of Gairloch, Bart.
THIRD DISTRICT—Wm. Maxwell of Carruchan.
FOURTH DISTRICT—John J. Hope Johnstone of Annandale, M.P.
FIFTH DISTRICT—James Connell of Conheath.
SIXTH DISTRICT—James Ballantyne of Holylee.
SEVENTH DISTRICT—Richard D. Campbell of Jura.

1. For the best Tup, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age, . . . £5
3. For the best two Shearling Tups, . . . £5
4. For the best Pen of five Ewes, not less than two Shear, £5
5. For the best Pen of five Gimmers or Shearling Ewes, . £4

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own lands.

In 1861,

Nos. 1, 2, 3, 4, and 5, are in competition for the second year.

Nos. 6 and 7 compete for local Premiums.

3. BLACK-FACED BREED.

DISTRICTS.

1. *The Island of Arran.*
2. *The District in connection with the Gatehouse Society.*
3. *The Upper Ward of Lanarkshire.*
4. *The District of Argyll.*
5. *The County of Dumbarton.*
6. *The Districts of Badenoch and Rothiemurchus.*

Conveners of Committees.

FIRST DISTRICT—James Paterson, Whitehouse.
SECOND DISTRICT—Walter M'Culloch of Ardwall.
THIRD DISTRICT—John Ord Mackenzie of Dolphinton.
FOURTH DISTRICT—William Campbell of Ormsary.
FIFTH DISTRICT—Alexander Smollett of Bonhill.
SIXTH DISTRICT—Cluny Macpherson.

1. For the best Tup, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age, . . . £5
3. For the best two Shearling Tups, . . . £5
4. For the best Pen of five Ewes, not less than two Shear, £5
5. For the best Pen of five Gimmers or Shearling Ewes, . £4

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own lands.

In 1861,

Nos. 1 and 2 are in competition for the second year.
Nos. 3 and 4 for the first year.

Nos. 5 and 6 compete for local Premiums.

RULES OF COMPETITION.

1. The Members of the Society in the several Districts are appointed Committees of Superintendence, as in Nos. 1 and 2 of the Regulations for Cattle Competitions, and they shall be convened by their respective Conveners in the same manner and for the same purposes as specified in these regulations.

2. The Competition shall take place before the 1st of November, and the time and place must be publicly intimated by each Convener within his District.

3. Tups shall have served the usual number of Ewes for at least three weeks during the previous season. All prize Tups must serve within the District. The Competitions are open to Tups not belonging to the District, provided they are left for service. Ewes must have reared Lambs during the season. Ewes and Gimmers must be taken from regular breeding hirsels.

4. The Premiums shall not be divided. No Money Premiums shall be adjudged unless there are three lots exhibited, and only one-half if there are not six lots. Each Competitor may show two lots. For the Medal two lots authorise an award. The other Regulations for Cattle Competitions—in regard to the placing of Stock—the exclusion of Animals which have gained Premiums at previous shows—the right of a Tenant, under certain circumstances, to compete for the Medal—reporting false entries—the Regulation as to expenses——the period within which Premiums must be applied for—and the manner in which the Reports must be certified and transmitted—are applicable to the Premiums for Sheep.

5. The Society gives these Premiums for three alternate years in each District, if, during the intervening years premiums are awarded by the District to an amount not less than one half of the Society's Premiums, and for the same description of the Stock. Reports of these intermediate Competitions must be lodged by the 15th of November, or the Society's grant shall terminate.

6. Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts. These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of November.

4. SHEARING SHEEP.

The Silver Medal will be given to the best Sheep-shearer in each of the Districts in which the Premiums for sheep are in operation.

CONDITIONS.

1. Money Premiums must be awarded by the District at each Competition, to the amount of not less than £2.

2. The District Convener will fix the time and place of Competition, and make all necessary arrangements.

3. The Medal shall not be awarded unless there are three Competitors, and it shall always accompany the highest Money Premium. If two or more lots appear to be equally well executed, preference should be given to that executed within the shortest time.

4. The Conveners shall report the particulars of the Competition and the award of the Judges to the Society, along with the Report of the Sheep Premiums in the District.

SECTION 4. SWINE.

DISTRICTS.

1. *The County of Edinburgh.*
2. *The District in connection with the Moffat Society.*
3. *The District in connection with the Jedburgh Society.*

Conveners of Committees.

FIRST DISTRICT—R. B. Wardlaw Ramsay of Whitehill.
SECOND DISTRICT—J. J. Hope Johnstone, M.P.
THIRD DISTRICT—John Ord of Muirhouselaw.

1. For the best Boar belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Boar, ... £4
3. For the second best, ... £2
4. For the best Breeding Sow, . . . £3
5. For the second best, ... £1

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own lands.

The above Premiums are given to each District for three consecutive years.

In 1861,

No. 1 is in competition for the last year.
Nos. 2 and 3 for the first year.

The Regulations for Cattle Competition are generally to be held as applicable to the Premiums for Swine; and the Convener and Committee of the Society's Members in the District are accordingly referred to them.

Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts. These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of November.

CLASS III.

DAIRY PRODUCE.

DISTRICTS.

1. *The District of the Glasgow Society.*
2. *The District of Kintyre.*
3. *The County of Wigtown.*
4. *The County of Ayr.*
5. *The District of Nithsdale.*

Conveners of Committees.

FIRST DISTRICT—Mark Sprot of Garnkirk.
SECOND DISTRICT—John Lorn Stewart of Coll.
THIRD DISTRICT—David Guthrie, Stranraer.
FOURTH DISTRICT—Sir James Fergusson, Bart., M.P.
FIFTH DISTRICT—William Maxwell of Carruchan.

1. BUTTER.

1. For the best sample of Cured Butter (not less than 14 lbs.) belonging to a Proprietor or Factor—The Silver Medal.
2. For the best sample of Cured Butter (not less than 14 lbs.) belonging to a Tenant, or Proprietor farming the whole of his own lands, ... £3
3. For the second best, ... £2

2. CHEESE.

4. For the best couple of Sweet Milk Cheeses belonging to a Proprietor or Factor—The Silver Medal.
5. For the best couple of Sweet Milk Cheeses belonging to a Tenant, or Proprietor farming the whole of his own lands, £3
6. For the second best, ... £2

The above Premiums are given to each District for three consecutive years.

In 1861,

No. 1 is in Competition for the last year.
No 2 for the second year.
Nos. 3, 4, and 5, for the first year.

CONDITIONS

1. The Members of the Society, resident within the Districts, are appointed Committees of Superintendence, for the purposes expressed in the Regulations for Cattle competitions.

2. Competitors must certify that the Butter and Cheese exhibited by them are average specimens of the produce of their Dairies in 1861; and that the quantity produced during the season has not been less than 1 cwt. of Butter, or 2 cwt. of Cheese, The Committee shall fix such general regulations as they may consider proper—and, in particular, the time and place of competition. In the event of two or more competing lots being deemed equal in quality, the Premium shall be awarded to the Competitor who has made the larger quantity. The sucessful Competitors, before receiving the Premiums, are required to transmit to the Secretary a detailed Report of the whole process followed by them in the manufacture of their Butter or Cheese. There must be at least two Competitors for the Medal.

3. Reports of the award of the Premiums to be lodged with the Secretary on or before the 15th November 1861.

CLASS IV.

CROPS AND CULTURE.

1. GENERAL EXHIBITION OF SEED AT EDINBURGH

The Society will hold an Exhibition of Spring Seeds at Edinburgh on Tuesday, 26th February, and of Autumn Seeds on Tuesday, 1st of October, when the following Premiums will be offered:—

(1.) SPRING SHOW

The Silver and the Bronze Medal will be given for the first and second best sample of each of the following varieties:—

1. Talavera Wheat.
2. April Wheat.
3. Any other variety for Spring sowing.

4. Potato Oats.
5. Hopetoun Oats.
6. Early Angus Oats.
7. Late Angus Oats.
8. Sandy Oats.
9. Berley Oats.
10. Black Tartar Oats.
11. Any other variety of Oats

12. Common Barley.
13. Chevalier Barley.
14. Any other variety of Barley.

15. Early Field Beans.
16. Late Field Beans.

17. Scotch Tares.

(2.) AUTUMN SHOW.

1. Hunter's Wheat.
2. Hopetoun Wheat.
3. Fenton Wheat.
4. Woolly-Eared Wheat.
5. Red Chaff White Wheat.
6. Red Straw White Wheat.
7. Any other variety of White Wheat.

8. Lammas Red Wheat.
9. Spalding Wheat.
10. Browick Wheat.
11. Any other variety of Red Wheat.

CONDITIONS.

1. Competitors must lodge with the Secretary a note of the varieties which they intend to Exhibit, not later than Wednesday the 20th of February for the Spring Show, and Wednesday the 25th of September for the Autumn Show.

2. Exhibitors shall bring to the door of the Corn Exchange not later than 10 A M. on the day of the Show—5 quarters of each variety of the Grain or Beans he means to exhibit, and 3 quarters of the Tares, from which a sample of 4 bushels shall be taken by the Committee for the inspection of the Judges.

3. The Judges shall be guided in their awards—1*st*, By the purity of the Seed; 2*d*, By its freeness from extraneous Seeds; and, 3*d*, Where there is an equality in these respects, by the weight To authorise an award, there must be at least two Competitors.

4. Successful Competitors must transmit 2 quarts of each kind of Seed, addressed to the Secretary at the Society's Museum, George IV. Bridge, along with a statement showing as accurately as possible the produce per Imperial Acre, the weight per bushel, and the altitude, exposure, and nature of the soil on which the crops were raised, together with the dates of sowing and reaping. A tabular form will be supplied for this statement.

5. All Seeds must have been grown by the Exhibitor.

2. DISTRICT EXHIBITIONS OF SEED.

The Society, with a view of aiding Local Associations in the improvement of the different Grains, Grasses, Roots, &c., offers the

Silver Medal to the Grower of the best Seeds for which Premiums in money shall have been awarded in the following districts :—

1. County of INVERNESS: Convener, Arthur Forbes of Culloden.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Perennial Rye Grass.

2. County of NAIRN: Convener, W. A. Stables, Cawdor Castle.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Perennial Rye Grass.

3. County of FIFE: Convener, Alex. Bethune of Blebo.
   1. Any variety of Wheat.
   2. Any variety of Barley
   3. Any variety of Oats.
   4. Perennial Rye Grass.

4. County of WIGTOWN: Convener, Viscount Dalrymple.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Perennial Rye Grass.

5. County of AYR: Convener, Sir James Fergusson, Bart., M.P.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Perennial Rye Grass.

6. County of FORFAR. Convener, Thos. Macpherson Grant of Craigo.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Perennial Rye Grass.

7. County of STIRLING: Convener, J. Arch. Shaw Stewart of Carnock.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Any variety of Beans.
   5. Tares.

8. District of WESTER ROSS: Convener, Keith W. Stewart Mackenzie of Seaforth.
   1. Any variety of Wheat.
   2. Any variety of Barley.
   3. Any variety of Oats.
   4. Perennial Rye Grass.

9. District of the BLACK ISLE SOCIETY: Convener, Sir J. J. R. Mackenzie, Bart.
   1. Any variety of Barley.
   2. Any variety of Oats

CONDITIONS.

1. In each District, the Convener shall fix the time and place of Competition, appoint the Judges, and make all other necessary arrangements, in concurrence with the other Members of the Society, and the local Association of the District. Conveners will be furnished with blank Schedules for reporting the awards.

2. The quantity shown in Competition by each Grower must not be less than three quarters of each variety of Grain, or two quarters of Beans or Grass Seeds. To authorise the award of the Medal, there must at least be two Competitors. The first Premium awarded by the District shall not be less than £1 for each kind of grain for which a Medal is claimed.

3. The Judges shall be guided in their awards—1*st*, By the purity of the Seed; 2*d*, By its freeness from extraneous seeds; and, 3*d*, Where there is an equality in these respects, by the weight.

4. Successful Competitors must immediately transmit, free of expense, two quarts of each kind of seed, addressed to the Secretary at the Society's Museum, George IV. Bridge, Edinburgh.

5. The Returns must show, as accurately as possible, the produce per imperial acre, also the altitude, exposure, and nature of the soil on which the crops were raised, together with the dates of sowing and reaping, and the weight per bushel. The varieties for which Premiums have been given must be named Reports of the several Competitions must be lodged by the 15th of November.

6. The Medals will be continued in each District for five consecutive years. Applications from other Districts must be lodged with the Secretary of the Society by 1st December next.

3. GREEN CROPS ON SMALL POSSESSIONS.

With the view of improving the cultivation of small possessions by the introduction of Green Crops, the following Premiums will be awarded:

For the best Green Crop, . . .	£3 0
For the second best do., . . .	£2 10
For the third best do., . . .	£1 10
For the fourth best do., . . .	£1 0

DISTRICTS.

1. The Parishes of KENMORE and KILLIN, including the portion of the Parish of WEEM on Loch Tay—Convener, James F. Wylie, Bolfracks.
2 The Island of SKYE—Convener, Lord Macdonald, or his Factor.
3 The *Quoad Sacra* Parish of NEW PITSLIGO—Convener, Sir John Stuart Forbes of Pitsligo. Bart.
4 The Mainland, or any of the Islands of ORKNEY—Convener, David Balfour of Balfour, and J. G. Heddle of Melsetter.

CONDITIONS.

1 The Competition to be limited to Tenants occupying not more than 40 acres of land, and to be under the charge of the Society's Members in the different districts.

2. At least one-half of the Green Crop to be Turnips, and that portion which is in Green Crop in 1861 should be sown out, with sufficient quantities of Clovers and Rye Grass, with the White Crop in 1862.

3. Should there be only one Competitor, the Committee may allow him such portion of one of the Premiums as they may think merited. The Committee may withhold all or any portion of the Premiums.

4. Inspectors, to be fixed by the respective Committees, shall decide the Premiums.

5. The awards to be intimated to the Secretary of the Society on or before the 15th of November in each year, and Conveners are particularly requested to state in their Reports the proportion of each lot cropped, as above mentioned, and to offer any suggestions which they may consider of importance.

4. PLOUGHING COMPETITIONS.

The Silver Medal will be given to the Winner of the first Premium at Ploughing Competitions, where there are fifteen Ploughs

and Premiums to the amount of Three Sovereigns. To authorise the issue of the Medal, a Report, in the following terms, must be made to the Secretary, within one month of the date of the Competition, by a Member of the Society :—

I of Member of the Highland and Agricultural Society, hereby certify, that I attended a Ploughing Competition at on the when ploughs competed; of land was assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz. :—

[Here enumerate the names and designations of successful Competitors.]

A Ploughman is to receive no assistance, and his work is not to be touched by others.

In estimating the work, attention should be directed to its sufficiency below, as well as to its neatness above the surface.

On land of average tenacity, the rate of ploughing should not be less than an imperial acre in ten hours.

A Ploughman cannot carry more than one Medal in the same season.

A Member can only report one Match in the same season.

5. REAPING MACHINES.

With the view of encouraging the management of Reaping-Machines, the Silver Medal will be given to the Servant found most expert at a trial, when not less than Four Machines have been worked, and Premiums to the amount of Two Sovereigns are awarded. Reports must be lodged with the Secretary by a Member who has inspected the work, not later than the 1st of November.

6. MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society being anxious to co-operate with local Associations in their efforts to promote improvement, will give a limited number of Silver Medals annually, in addition to the Money Premiums which may be awarded to Tenants by such Associations—.

1. Stock.—To local Societies not on the list of District Competitions, awarding Premiums to the amount of £10, and report-

ing their Shows to the Secretary—The Silver Medal for the best Male and for the best Female animal of any Pure Breed.

Applied for by the Forbes and Fordyce Association—Convener Sir John Stuart Forbes of Pitsligo, Bart.

The Western District of Mid-Lothian—Convener, Peter M'Lagan of Pumpherston.

The Penicuik Society—Convener, The Right Hon. Sir George Clerk, Bart.

The District of Breadalbane and Weem—Convener, James F. Wyllie. Bolfracks.

The Buchan Society—Convener, George Baird of Strichen.

The Wester Ross Club—Convener, Keith W. Stewart Mackenzie of Seaforth.

The Avondale Society—Convener, J. P. Alston of Muirburn.

The Dalbeattie Society—Convener, Wellwood H. Maxwell of Munches.

2. For the best managed FARM—The Silver Medal.

Applied for by the Nairnshire Society—Convener, Wm. Alexander Stables, Cawdor Castle.

The Inverness Society—Convener, Arthur Forbes of Culloden.

The Carrick Society—Convener, P. W. Kennedy of Drumellan.

The East Kilpatrick Society—Convener, Archibald Campbell Colquhoun, yr. of Killermont.

3. For the best managed DAIRY—The Silver Medal.

Applied for by the Bute Society—Convener, Thomas Gibson of Spittal.

The Mauchline Society—Convener, Colonel Ferrier Hamilton.

4. For the best managed GREEN CROP—The Silver Medal.

Applied for by the Bute Society—Convener, Thomas Gibson of Spittai.

The Inverness Society—Convener, Arthur Forbes of Culloden

The District of Breadalbane—Convener, James F. Wyllie, Bolfracks.

The Dalrymple Society—Convener, Sir James Fergusson, Bart., M.P.

The East Kilpatrick Society—Convener, Archibald Campbell Colquhoun, yr. of Killermont.

The Leochel-Cushnie Society—Convener. Arthur Forbes Gordon of Rayne, W.S.

The Clackmannan Society—Convener, James Johnstone of Alva.

5. For the best managed HAY CROP—The Silver Medal.

Applied for by the Clackmannanshire Society—Convener, James Johnstone of Alva.

6. For the best kept FENCES—The Silver Medal.

No Application.

7. For the best managed DUNGHILL—The Silver Medal.

Applied for by the District of Breadalbane—Convener, James F. Wyllie, Bolfracks.

8. To the Labourer most expert and efficient in opening and filling Drains and otherwise executing the works necessary in thorough Draining—The Silver Medal.

Applied for by the Nairnshire Society—Convener, Wm. Alex. Stables, Cawdor Castle.

The Carrick Society—Convener, P. W. Kennedy of Drumellan.

9. To the labourer most expert in cutting Hedges—The Silver Medal.

No Application.

The Medals to be issued will be limited to ten in each class, except No. 1. Reports of the several Competitions, and applications for 1861, must be lodged by 1st November next. The money Premiums given in the District must be £2 in each case, and in No. 1 £10.

CLASS V.

COTTAGES AND GARDENS.

The following Premiums are offered for competition in the Parishes after mentioned. The Medals and one-half of the Premiums are given by the Society, and the other half is contributed by the respective Parishes.

COTTAGES.

1. For the best kept Cottage in each Parish—One Pound Five Shillings; and where there are four competitors—The Silver Medal.
2. For the second best—One Pound.
3. For the third best—Fifteen Shillings.

GARDENS.

1. For the best kept Cottage Garden in each Parish—One Pound Five Shillings; and where there are four competitors—The Silver Medal.
2. For the second best—One Pound.
3. For the third best—Fifteen Shillings.

Aberdeenshire.

FORGUE—Convener, Robert Simpson of Cobairdy.
LEOCHEL-CUSHNIE—Convener, Arthur Forbes Gordon of Rayne.
STRICHEN—Convener, George Baird of Strichen.

Fifeshire.

FALKLAND—Convener, Francis Howden, Falkland.
NEWBURGH and ABDIE—Convener, Dr Lyell, Newburgh.

Stewartry of Kirkcudbright.

URR—Convener, Wellwood H. Maxwell of Munches.

Lanarkshire.

LAMINGTON—Convener, Alexander Baillie Cochrane of Lamington, M.P.
LESMAHAGOW—Convener, W. E. Hope Vere of Blackwood.
COVINGTON—Convener, Sir Wyndham Carmichael Anstruther, Bart.

Perthshire.

ST MARTINS—Convener, William Macdonald Macdonald of St Martins.

Roxburghshire.

ANCRUM—Convener, Sir William Scott of Ancrum, Bart, M.P.

Wigtownshire.

KIRKCOLM—Convener, David Guthrie, Stranraer.
LESWALT—Convener, Sir Andrew Agnew of Lochnaw, Bart., M.P.
PORT-PATRICK—Convener, Sir Edward Hunter Blair, Bart.
OLD LUCE—Convener, Captain Dalrymple Hay, yr. of Park Place.

CONDITIONS.

1. Competitions may take place in the different Parishes for Cottages and Gardens, or for either separately.

2. In either case, the occupiers of Gentlemen's Lodges and Gardeners' Houses are excluded, as well as Gentlemen's Servants occupying Cottages in the Policies, or on land in the natural possession of their masters The inspection must be completed by the 1st of October In making the inspection, the Conveners may take the assistance of any competent judge

3. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, shall not exceed £5 sterling. A Competitor who has gained a Premium in a previous year cannot compete again for the same or a lower Premium.

4. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is of thatch, it must be in good repair, though in the occupation of a tenant. The interior and the external conveniences must be clean and orderly—the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to competitors who, in addition to the above requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

5. In estimating the claims for the Garden Premiums, the Judges should have in view—the sufficiency and neatness of the fences; the cleanness of the ground, and neatness of the walks; the quality of the crops, and general productiveness of the garden; and the choice of crops.

6. Reports, stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary on or before 1st of November next.

Parishes desirous of these Premiums must lodge applications with the Secretary on or before the 1st November next.

MEDALS FOR COTTAGES OR GARDENS.

The Society will issue annually twelve Medals to local Associations or individuals, who at their own expense establish Premiums for Cottages or Gardens.

The Medals will be issued upon a Report by a Member of the Society, in the terms required by the preceding conditions, describing the merits of the Cottages or Gardens. The Reports to be lodged with the Secretary on or before the 15th October 1861.

Applied for by The Linlithgow Society.
Lord Kinnaird.
Mrs Douglas Baird of Closeburn.
Lanark Horticultural Society.
Eastern District of Stirling.
The Proprietors of Lundin.
The Parishes of Forglen and Alvah.
Mauchline Horticultural Society.
The Newburgh Gardening Society.
The Conan Garden Society.
United East Lothian Society.

IMPROVING EXISTING COTTAGES.

To the Proprietor in Scotland who shall report the Improvement of the greatest number of Cottages in the years 1858, 1859, and 1860—The Gold Medal.

BUILDING NEW COTTAGES.

To the Proprietor in Scotland who shall report the Erection of the greatest number of approved Cottages during the years 1857, 1858, 1859, and 1860—The Gold Medal.

CONDITIONS.

1. Claims for the above Premiums must be lodged with the Secretary on or before the 1st of October next, to allow an inspection to be made of the different Cottages. The inspection will be conducted by a Committee of the Society's Members, and Reports must be transmitted to the Secretary on or before the 1st November.
2. The annual value of the Cottage or Cottages separately, with the garden ground, must not exceed £5.

3. In estimating the claims of Competitors, the following points will be kept in view:—The external appearance of the Cottages; their internal accommodation; the arrangements of the outhouses; the means of drainage and ventilation; and the expense of the building or of the alteration, compared with its durability and accommodation. When the Cottages of one Competitor are superior in style and comfort to those of another, though not so numerous, the Inspectors will give them the preference, provided they amount at least to three, and have been erected at a moderate expense.

4. Parties competing will forward to the Society Plans, Specifications, and Estimates, of which, and of all information sent therewith, copies may be taken for publication, if the Society shall see fit, and the originals returned to the parties within six months, if desired.

ACCOMMODATION FOR FARM-SERVANTS.

To the Proprietor in Scotland who shall have Erected on his estate the most approved Farm-buildings in reference to the proper accommodation of Farm-servants—The Gold Medal

Reports, Plans, and Specifications to be lodged by the 1st November 1861.

AGRICULTURAL MEETING

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

AT

PERTH,

ON THE 29TH, 30TH, AND 31ST JULY, AND 1ST AND 2D AUGUST 1861.

HIS GRACE THE DUKE OF ATHOLE, K.T.,
President of the Society.

THE RIGHT HON. THE EARL OF MANSFIELD, K.T.,
Chairman of the Local Committee.

WILLIAM SMYTHE, ESQ. OF METHVEN,
Convener of the Local Committee.

The District connected with the Show comprises the Counties of PERTH, FIFE, KINROSS and CLACKMANNAN, and Western part of FORFARSHIRE.

The Show-Yard will be erected on the South Inch.

GENERAL ARRANGEMENTS.

IMPLEMENTS

RECEIVED in the Yard on 26th and 27th July. TRIED and JUDGED on 29th and 30th. EXHIBITED from **2** till **5 P.M.** on 31st July, and from **7 A.M.** till **5 P.M.** on 1st August.

STOCK

RECEIVED in the Yard on 30th July and morning of 31st. JUDGED before **2 P.M.** on 31st. EXHIBITED from **2** till **5 P.M.** on 31st July, and from **7 A.M.** till **5 P.M.** on 1st August.

PRIZE STOCK, IMPLEMENTS, &c.

EXHIBITED from **9 A.M.** till **1 P.M.** on 2d August. The Yard will be closed at **3 P.M.** when the Meeting terminates.

The Competition is open to Exhibitors from all parts of the United Kingdom.

No Certificate of Entry can be received after Friday, 14th June.

Members of the Society have free access to the Show-Yard, and are exempted from Entry-Money of 2½ per cent. on Premiums.

Tenants, Members of the Society, may obtain Tickets for Farm-Servants at 6d. See Rule No. 2.

CLASS I.—CATTLE.

SHORT-HORN.

Section		
1	Best Bull calved before 1st Jan. 1859,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
	Breeder of the best Bull,	The Silver Medal.
2	Best Bull calved after 1st Jan. 1859,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
3	Best Bull calved after 1st Jan. 1860,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
4	Best Cow of any age,	Fifteen Sovereigns.
	Second best,	Eight Sovereigns.
	Third best,	The Bronze Medal.
5	Best Heifer calved after 1st Jan. 1859,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
6	Best Heifer calved after 1st Jan. 1860,	Eight Sovereigns.
	Second best,	Four Sovereigns.
	Third best,	The Bronze Medal.

POLLED.

7	Best Bull calved before 1st Jan. 1859,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
	Breeder of the best Bull,	The Silver Medal.
8	Best Bull calved after 1st Jan. 1859,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
9	Best Bull calved after 1st Jan. 1860,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
10	Best Cow of any age,	Fifteen Sovereigns
	Second best,	Eight Sovereigns.
	Third best,	The Bronze Medal.
11	Best Heifer calved after 1st Jan. 1859,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
12	Best Heifer calved after 1st Jan. 1860,	Eight Sovereigns.
	Second best,	Four Sovereigns.
	Third best,	The Bronze Medal.

Note—When Galloways exceed three in any Section they will be judged separately, and distinct Premiums be allowed.

AYRSHIRE.

Section		
13	Best Bull calved before 1st Jan. 1859,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, ...	The Silver Medal.
14	Best Bull calved after 1st Jan. 1859,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
15	Best Cow in Milk of any age, . . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
16	Best Cow in Calf of any age, . . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
17	Best Heifer calved after 1st Jan. 1859,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
18	Best Heifer calved after 1st Jan. 1860,	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

HIGHLAND.

19	Best Bull calved before 1st Jan. 1858,	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Bull, ...	The Silver Medal.
20	Best Bull calved after 1st Jan. 1858,	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
21	Best Bull calved after 1st Jan. 1859,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
22	Best Cow of any age, ...	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
23	Best Heifer calved after 1st Jan. 1858,	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
24	Best Heifer calved after 1st. Jan. 1859,	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

FAT STOCK.

Section		
25	Best Ox of any pure or Cross breed calved after 1st Jan. 1858, . .	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
26	Best Ox of any pure or Cross breed calved after 1st Jan. 1859, . .	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
27	Best Ox of any pure or Cross breed calved after 1st Jan. 1860, . .	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
28	Best Highland Ox calved after 1st Jan. 1857, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
29	Best Highland Ox calved after 1st Jan. 1858, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
30	Best Cross Heifer calved after 1st Jan. 1859, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.
31	Best Cross Heifer calved after 1st Jan. 1860, ...	Medium Gold Medal.
	Second best, ...	The Silver Medal.
	Third best, ...	The Bronze Medal.

CLASS II.—HORSES

FOR AGRICULTURAL PURPOSES.

Section		
1	Best Stallion foaled before 1st Jan. 1858, ...	Thirty Sovereigns.
	Second best, ...	Fifteen Sovereigns.
	Third best, ...	The Bronze Medal.
	Breeder of the best Stallion, . . .	The Silver Medal.
2	Best Entire Colt foaled after 1st Jan. 1858, ...	Twenty Sovereigns.
	Second best, ...	Ten Sovereigns.
	Third best, ...	The Bronze Medal.

Section		
3	Best Entire Colt foaled after 1st Jan. 1859,	Fifteen Sovereigns.
	Second best,	Eight Sovereigns.
	Third best,	The Bronze Medal.
4	Best Entire Colt foaled after 1st Jan. 1860,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
5	Best Mare (with Foal at foot) foaled before 1st Jan. 1858,	Twenty Sovereigns.
	Second best,	Ten Sovereigns.
	Third best,	The Bronze Medal.
6	Best Mare (in foal) foaled before 1st Jan. 1858,	Fifteen Sovereigns.
	Second best,	Eight Sovereigns.
	Third best,	The Bronze Medal.
7	Best Filly foaled after 1st Jan. 1858,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.
8	Best Filly foaled after 1st Jan. 1859,	Eight Sovereigns.
	Second best,	Four Sovereigns.
	Third best,	The Bronze Medal.
9	Best Filly foaled after 1st Jan. 1860,	Six Sovereigns.
	Second best,	Three Sovereigns.
	Third best,	The Bronze Medal.

PONIES.

10	Best Pony Stallion, not over 14 nor under 12 hands,	Eight Sovereigns.
	Second best,	Four Sovereigns.
	Third best,	The Bronze Medal.
11	Best Pony Mare, of the same height,	Four Sovereigns.
	Second best,	Two Sovereigns.
	Third best,	The Bronze Medal.

CLASS III.—SHEEP.

BLACKFACED.

Section		
1	Best Tup not more than four shear,	Ten Sovereigns.
	Second best,	Five Sovereigns.
	Third best,	The Bronze Medal.

Section		
2	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best Pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
4	Best Pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

CHEVIOT.

5	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
7	Best Pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
8	Best Pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

LEICESTER.

9	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
10	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
11	Best Pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
12	Best Pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

LONG-WOOLLED OTHER THAN LEICESTER.

Section		
13	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
14	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
15	Best Pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
16	Best Pen of Five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

SOUTHDOWN.

17	Best Tup not more than four shear, .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
18	Best Dinmont or Shearling Tup, . .	Ten Sovereigns.
	Second best, ...	Five Sovereigns.
	Third best, ...	The Bronze Medal.
19	Best Pen of five Ewes not more than four shear, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
20	Best Pen of five Shearling Ewes or Gimmers, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.

CLASS IV.—SWINE.

Section		
1	Best Boar, large breed, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
2	Best Boar, small breed, ...	Eight Sovereigns.
	Second best, ...	Four Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best Sow, large breed, ...	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

Section		
4	Best Sow, small breed, ...	Six Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
5	Best Pen of three Pigs, not exceeding 8 months old, large breed, . . .	Four Sovereigns.
	Second best, ...	Two Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best Pen of three Pigs, not exceeding 8 months old, small breed, . .	Four Sovereigns.
	Second best, ...	Two Sovereigns.
	Third best, ...	The Bronze Medal.

CLASS V.—POULTRY.

Coloured Dorking.

Section		
1	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
2	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

White Dorking

3	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal
4	Best Cockerel and 2 Pullets, .	The Silver Medal.
	Second best, ...	The Bronze Medal.

Coloured Cochin-China.

5	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
6	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best.	The Bronze Medal.

White Cochin-China.

7	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
8	Best Cockerel and 2 Pullets, . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

BRAMAHPOOTRA.

Section		
9	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
10	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

MALAY.

11	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
12	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

SPANISH.

13	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
14	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

GOLDEN HAMBURG.

15	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
16	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

SILVER HAMBURG.

17	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
18	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

POLISH.

19	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
20	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

GAME.

21	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
22	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

Any other Breed.

Section		
23	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
24	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

Bantams.

25	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.
26	Best Cockerel and 2 Pullets, . . .	The Silver Medal.
	Second best, ...	The Bronze Medal.

Capons—*Of any Breed.*

27	Best 3 Capons, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

Ducks—*White Aylesbury.*

28	Best Drake and 2 Ducks, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

Rouen Ducks.

29	Best Drake and 2 Ducks, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

Any other Breed.

30	Best Drake and 2 Ducks, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

Turkeys—*Black Norfolk.*

31	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best.	The Bronze Medal.

Turkeys—*Any other Breed.*

32	Best Cock and 2 Hens, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

Geese.

33	Best Gander and 2 Geese, ...	The Silver Medal.
	Second best, ...	The Bronze Medal.

CLASS VI.—DAIRY PRODUCE.

Section		
1	Best Sample of Cured Butter, . . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
2	Best Sample of Powdered Butter, . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
3	Best Sample of Fresh Butter, . . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
4	Best two Sweet Milk Cheeses, . . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
5	Best two Skimmed Milk Cheeses, . .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.
6	Best two English Cheeses, ...	Five Sovereigns.
	Second best, ...	Three Sovereigns
	Third best, ...	The Bronze Medal.
7	Best two Imitation English Cheeses, .	Five Sovereigns.
	Second best, ...	Three Sovereigns.
	Third best, ...	The Bronze Medal.

CLASS VII.—IMPLEMENTS AND MACHINES.

When an Implement exhibits any original and important Improvement, the Judges may recommend an honorary Premium in addition to the Money.

The Bronze Medal will be given as a Second Prize in each Section.

Section		
1	Best Two-horse Plough for general purposes, ...	Two Sovereigns.
2	Best Trench or Deep-furrow Plough, .	Two Sovereigns.
3	Best Subsoil Plough for Two Horses,	Two Sovereigns.
4	Best Subsoil Plough for Three or Four Horses, ...	Three Sovereigns.
5	Best Double Mould-Board Plough, . .	Two Sovereigns.
6	Best Ribbing Plough, ...	Two Sovereigns.
7	Best Grubber or Cultivator, ...	Three Sovereigns.
8	Best Norwegian Harrow, ...	Three Sovereigns.
9	Best Pulverising Land-Roller, . . .	Three Sovereigns.
10	Best Consolidating Land-Roller, . .	Three Sovereigns.

Section		
11	Best Land-Presser for preparing Seed-bed for Grain, ...	Three Sovereigns.
12	Best Ribbing Machine, ...	Two Sovereigns.
13	Best Harrows for Heavy Land, . . .	Two Sovereigns.
14	Best Harrows for Light Land, . . .	Two Sovereigns.
15	Best Harrows for covering Grass Seeds,	Two Sovereigns.
16	Best Common Swing-Trees for Two Horses, ...	One Sovereign.
17	Best Equalising Swing-Trees for more than two Horses, ...	One Sovereign.
18	Best Broadcast Sowing-Machine for Grain,	Five Sovereigns.
19	Best Drill Sowing-Machine for Grain,	Five Sovereigns.
20	Best Sowing-Machine for Grass Seeds,	Five Sovereigns.
21	Best Sowing-Machine for Turnips, . .	Three Sovereigns.
22	Best Sowing-Machine for Turnips with Manure, ...	Five Sovereigns.
23	Best Dibbling or Drop Sowing-Machine with Manure, ...	Three Sovereigns.
24	Best Sowing-Machine for Mangold, .	Three Sovereigns.
25	Best Sowing-Machine for Carrots, . .	Three Sovereigns
26	Best Three-row Sowing-Machine for Beans, ...	Two Sovereigns.
27	Best One-row Sowing-Machine for Beans, ...	One Sovereign.
28	Best Machine for Pulverising Guano, &c.,	Three Sovereigns.
29	Best Machine for Distributing Guano,	Four Sovereigns.
30	Best Liquid Manure Distributing-Machine, ...	Three Sovereigns.
31	Best Horse-Hoe for Drilled Grain Crops,	Three Sovereigns.
32	Best Horse-Hoe for Green Crops, . .	Two Sovereigns.
33	Best Machine for Singling Turnips, .	Three Sovereigns.
34	Best Machine for Raising Potatoes, .	Three Sovereigns.
35	Best Scythe for general purposes, . .	One Sovereign.
36	Best Fanners or other Machine for Winnowing Grain, ...	Three Sovereigns.
37	Best Fanners or other Machine for Cleaning Grass Seeds, ...	Three Sovereigns.
38	Best Weighing-Machine for Grain, .	Two Sovereigns.
39	Best Weighing-Machine, indicating from 1 lb. to 2 tons, ...	Four Sovereigns.
40	Best Straw-Cutter for Hand-labour, .	Two Sovereigns.
41	Best Straw-Cutter for Power. . . .	Three Sovereigns.
42	Best Turnip-Cutter for Cattle, . . .	Two Sovereigns.
43	Best Turnip-Cutter for Sheep, . . .	Two Sovereigns.

Section		
44	Best Turnip-Cutter, to attach to a Cart,	Three Sovereigns.
45	Best Machine for Pulping Turnips, .	Three Sovereigns.
46	Best Root-Washer, ...	One Sovereign.
47	Best Linseed-Bruiser for Hand-labour,	Two Sovereigns.
48	Best Oilcake-Bruiser for Hand-labour,	Two Sovereigns.
49	Best Grain Grinder or Bruiser for Power,	Five Sovereigns.
50	Best Steaming-Apparatus for Food, .	Five Sovereigns.
51	Best Feeding-Troughs for Byres, . .	One Sovereign.
52	Best Feeding-Troughs for Sheep, . .	One Sovereign.
53	Best Sheep-Fodder Rack, ...	Two Sovereigns.
54	Best Churn worked by Hand, . . .	Two Sovereigns.
55	Best Churn worked by Power, . . .	Three Sovereigns.
56	Best Cheese-Press, ...	One Sovereign.
57	Best General Set of Dairy Utensils, .	Two Sovereigns.
58	Best One-Horse Cart, with Harvest-Frame,	Four Sovereigns.
59	Best Harvest-Cart, ...	Four Sovereigns.
60	Best Light Spring-Cart, ...	Two Sovereigns.
61	Best Wheelbarrow, ...	One Sovereign.
62	Best Barrow for conveying Cooked Food,	One Sovereign.
63	Best Fittings for Farm Stables, . .	Two Sovereigns.
64	Best Farm Harness, ...	One Sovereign.
65	Best Stack-Pillars, with Framework, .	Two Sovereigns.
66	Best Field-Gate, constructed entirely of Iron, ...	One Sovereign.
67	Best Field-Gate, not constructed entirely of Iron, ...	One Sovereign.
68	Best Dunghill-Gate, to open at different elevations, ...	One Sovereign.
69	Best Iron Hurdles for Cattle-Fence, .	One Sovereign.
70	Best Iron Netting for Sheep-Fence, .	One Sovereign.
71	Best Wooden Hurdles or other Fencing for Sheep, ...	One Sovereign.
72	Best Pipe or Tile Machine for Hand or Power, ...	Six Sovereigns.
73	Best Tiles or Pipes for Field Drainage,	Two Sovereigns.
74	Best Glazed Socketed Pipes for Sewerage,	Three Sovereigns.
75	Best Tools for Cutting Field Drains, .	One Sovereign.
76	Best Tools for Cutting Open Drains in Hill Pastures, ...	One Sovereign.
77	Best General Set of Hand Implements for the Farm, ...	Two Sovereigns.
78	Best Gas Apparatus for Country Houses and Farm Steadings, ...	Five Sovereigns.

GENERAL REGULATIONS.

1. Members of the Society are admitted to the Show-yard without payment on exhibiting a "*Member's Ticket.*" Tickets will be sent to all Members residing in the District connected with the Show—the counties of Perth, Fife, Kinross, and Clackmannan, and Western part of Forfarshire. Members residing in other localities must apply for Tickets at the Secretary's Office *not later than the 20th of July.*

2. Tenant-farmers who are Members of the Society, and who reside within the District of the Show, may obtain Tickets of Admission to the Yard for their Farm-servants at Sixpence each, on applying at the Secretary's Office, No. 6 Albyn Place, or to the local Secretary, Mr Melville Jameson, Perth, *between the* 1st *of June and 20th July.* The names of the persons for whom the Tickets are required must be specified, and they will be available for Thursday, 1st August, only.

3. Stock must be the property, and in the possession, of the Exhibitor from the date of the Certificate of Entry, and the exact age must be stated in the Certificate.

4. Evidence may be required that Stallions and Bulls have had produce.

5. All Cows must have had Calves previous to the Show, and when exhibited, they must either be in milk or in calf: if in milk, birth must have been within 9 months previous to the Show; if in calf, birth must be certified within 4 months after the Show.

6. Heifers in Section 5 (two-year-old Short-horn Heifers), must be in calf when exhibited, and birth must be certified within 9 months after the Show.

7. Mares in Section 5 must have produced foals after 1st January 1861, and foals must be at foot, except when death can be proved. Mares in Section 6 must be in foal, and awards will be suspended till birth is certified.

8. Ewes and Gimmers must be taken from regular breeding flocks, and Ewes must rear Lambs in 1861.

9. An animal which has gained a first premium at a General Show of the Society cannot again compete in the same class. The Medium Gold Medal shall be awarded to any animal exhibited as extra Stock, which has previously obtained the Society's first premium as an aged Stallion, Bull, or Cow.

10. No animal shall bear on its rug, harness, pail, or other fittings, any initial, crest, or other mark of ownership, nor be distinguished otherwise than by the number indicating its place in the Catalogue.

11. Commendations will only be given for Extra Stock. In other classes the Judges shall restrict their awards to the Premiums offered.

12. The violation by an Exhibitor of any one of the Regulations will involve the forfeiture of all Premiums awarded to him.

13. Should it be proved to the satisfaction of the Directors that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Directors or Judges as to its qualification or properties, the case shall be reported to the first General Meeting, in order that the Exhibitor shall be disqualified from again competing at the Society's Shows, and his name, if he be a Member, struck from the roll.

14. When an animal has previously been disqualified by the decision of any Agricultural Association in Great Britain or Ireland, such disqualification shall

attach, if the Exhibitor, being aware of the disqualification, fail to state it, and the grounds thereof, in his entry, to enable the Directors to judge of its validity.

15. Protests against the awards of the Judges must be lodged with the Secretary not later than Ten A.M. on Thursday, 1st August, and parties must be in attendance at the Committee-room, in the Show-Yard, at Eleven, when protests will be disposed of.

16. From Eight A.M. on Monday, 29th July, till Two P.M. on Wednesday the 31st, when the Judges of Stock and Implements are employed, it shall be the duty of the Secretary to see that no person, on any pretext, remains in the Show-Yard, with the exception of the Deputation of Directors; the Committee engaged in placing Stock and Implements; the Members attending Judges; Exhibitors of Implements, and Workmen whose presence is required by the Judges; and the Servants in charge of Stock.

17. The Society will not be liable for any loss or damage which Stock, Implements, or other articles may sustain at the Show, or in consequence of having been sent to it.

18. The decisions of the Judges, as confirmed by the Directors, are final, and no appeal is competent.

19. The Premiums awarded will be paid after the 1st of January 1862. *Premiums not applied for within two years from the term of payment shall be forfeited.*

CERTIFICATES OF ENTRY.

20. Every Lot must be intimated by a Certificate of Entry lodged *not later than the 14th of June.* Printed forms will be issued on application to the Secretary, or to Mr Melville Jameson, Perth.

21. The Secretary will attend at Perth on the 13th and 14th of June, to receive and close the entries.

22. Admission-orders to the Yard for Stock, &c., will be forwarded by post previous to the Show.

23. Exhibitors, not Members of the Society, shall pay Entry-Money for Stock of 2½ per cent. on the highest Premium for which the Entry is made. Members may show three Lots of Stock in each Section free, but must pay the same per-centage on the Premium for each additional Lot. The Entry-Money for Implements, Poultry, and Dairy Produce is 2s. 6d. on each Lot, and Members may show two Lots free in each Section.

ACCOMMODATION FOR STOCK.

24. Covered accommodation will be provided for the whole of the Stock, and the following rates shall be paid by *all* Exhibitors at the time of making their Entries:—

	s.	*d.*
Stallions, and 3 and 2 year old Entire Colts..............	10	0
All other Horses and Cattle 2 years old and upwards....	7	6
Yearling Colts, Fillies, Bulls, and Heifers	5	0
Sheep and Swine per pen..................................	5	0
Poultry, per coop	2	6

25. The Yard will be open for the reception of Stock on Tuesday 30th July, and between Five and Seven o'clock on the morning of the 31st July. No Stock will be admitted after that hour.

26. Stock will be accommodated from Tuesday till Friday, and no Exhi-

bitor shall be permitted to remove Cattle, Sheep, or Swine from the Yard till Five P.M. on Thursday, or, if Prize Stock, till One P.M. on Friday, except on certificate by the Veterinary Surgeon employed by the Directors.

27. Horses may be withdrawn at Six each evening on a deposit of £2 for each animal, which shall be forfeited if the animal is not brought back at Six o'clock the following morning.

28. Servants in charge of Stock must bring their own buckets or pails. A first bedding for Horses, Cattle, and Swine, will be provided by the Society, but all other fodder and food for Stock will be supplied, at fixed prices hereafter to be published, by a Contractor employed by the Society.

PLACING AND JUDGING STOCK.

29. A Special Committee will superintend the placing of Stock, and will leave the Yard as soon as the Judges enter. Exhibitors may see their Stock properly placed, but they must immediately thereafter retire; and on no pretext shall any other parties be permitted to enter the Yard until it is opened to the public.

30. One servant will be admitted with each Lot. Bulls must be secured by a ring or screw in the nose, with a chain or rope attached. Stock shall be distinguished by numbers, and the owner's name must not be mentioned till the Premiums are decided.

31. The Judges will commence their inspection at Seven o'clock on Wednesday, 31st July. They shall decide without inquiry as to the names of parties or places, and with reference merely to the numbers which distinguish the animals. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit, more especially if there is only one Lot in the Section; and it shall be in their power to suggest the removal of any Lot which appears to them unworthy of being placed in the Yard.

32. A Member of Committee will attend each Section of the Judges. It will be his duty to see that no obstruction is offered to them; to communicate to the Secretary any question that may arise for the consideration of the Directors; to complete their reports; and to ticket the prize animals. None of the tickets so placed shall be removed.

33. It shall not be competent for any Exhibitor, nor for his Factor or Land-Steward, to act as a Judge or Attending Member.

PLACING AND JUDGING IMPLEMENTS.

34. The Show-Yard will be open for the reception of IMPLEMENTS on Friday, 26th July, and all articles must be placed by Saturday Evening. No article will be admitted without an Admission-order.

35. Exhibitors must attach to each Implement, when forwarded to the Show, a card bearing the Exhibitor's name, that of the Implement, and the No. of the Section in which it has been entered.

36. Articles entered in Competition under the Sections of the Premium-List shall be placed in the Yard according to their respective Sections, and this arrangement must not be disturbed so long as Implements are kept in the Yard.

37. Implements may be entered, not for competition, as General Collections. These shall not be tried nor reported on. The space required for them must be intimated on or before 14th June; a moderate charge will be made for it.

38. Articles may be entered as "*Extra*" for Medals, provided they do not fall within any Section of the Premium-List.

39. The Judges will commence their inspection on Monday, 29th July, at Eight o'clock, and resume it the following morning at Seven. Practical utility will be considered more than mere ingenuity of design; substantial workmanship will be preferred to highly finished execution; and due weight will in all cases be given to economy, both as regards the price of the Implement and the saving of the labour effected by it. The materials must be the same as those in ordinary use for sale, and the *bona fide* market price must be inserted in the certificate of entry, and attached to the article. It shall be in the power of the Judges to withhold the premium, when not, in their opinion, merited.

40. Implements may be removed from the Yard at Five o'clock on Thursday, 1st August; but the Yard will be kept open for exhibition and sale till Three o'clock on Friday.

PLACING AND JUDGING DAIRY PRODUCE.

41. Dairy Produce must be brought to the Show-Yard not later than Seven o'clock on the morning of Wednesday, 31st July. No Lot will be admitted without an Admission-order.

42. Samples of Cured and Powdered Butter not to be less than 14 lbs. Fresh Butter to be in three $\frac{1}{2}$-lb. rolls. Dairy Produce must be made on the Exhibitor's farm in 1861. At least 1 cwt. of the variety of Butter, and 2 cwt. of that of the cheese exhibited, must have been made during the season. The Lots shall be fair samples.

43. The Judges will be in attendance at Seven, and the Exhibition will be opened to the public at Two o'clock on Wednesday the 31st.

44. No article to be removed from the Yard till Five o'clock on Thursday the 1st.

PLACING AND JUDGING POULTRY.

45. Poultry may be brought to the Show-Yard on Tuesday afternoon, or between Five and Seven o'clock on the morning of Wednesday, 31st July. No Lot will be admitted without an Admission-order. Coops, food, and attendance will be found by the Society.

46. The Judges will be in attendance at Seven, and the Exhibition will be opened to the public at Two o'clock on Wednesday the 31st.

47. No Lot to be removed from the Yard till Five o'clock on Thursday the 1st.

EXHIBITION OF PRIZE STOCK AND IMPLEMENTS.

48. All Prize Animals, Implements, and Poultry must remain in the Show-Yard till One o'clock on Friday, 2d August, or the Premiums will be forfeited.

STOCK and IMPLEMENTS, when unsold, will be returned from the Show free by all Scotch Railways, except the GLASGOW and SOUTH WESTERN, on which full fares to and from the Show will be charged.

Premium Lists, Certificates of Entry, and Regulations, may be obtained by applying at the Secretary's Office, No. 6 Albyn Place, Edinburgh, or to Mr Melville Jameson, Perth.

The Secretary will attend at Perth on 13th and 14th June to close the entries.

AGRICULTURAL MEETING,

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

At KELSO, in 1862.

The District connected with the Show will comprise the Counties of BERWICK, ROXBURGH, and SELKIRK.

CATTLE.

Premiums in Money will be offered for the following Classes :—

SHORT-HORN.

Bulls calved before 1st January............1860.
Bulls calved after 1st January..............1860.
Bulls calved after 1st January..............1861.
Cows of any age.
Heifers calved after 1st January...........1860.
Heifers calved after 1st January...........1861.

POLLED.

Bulls calved before 1st January............1860.
Bulls calved after 1st January..............1860.
Bulls calved after 1st January..............1861.
Cows of any age.
Heifers calved after 1st January............1860.
Heifers calved after 1st January............1861.

Note.—When the number of Galloways exceeds Three in any Section, they shall be judged separately from Polled Angus and Aberdeen.

AYRSHIRE.

Bulls calved before 1st January............1860.
Bulls calved after 1st January..............1860.
Cows in Milk of any age.
Cows in Calf of any age.
Heifers calved after 1st January.. ....1860.
Heifers calved after 1st January...........1861.

HIGHLAND.

Bulls calved before 1st January............1859.
Bulls calved after 1st January..............1859.

Cows of any age.
Heifers calved after 1st January ....1859.
Heifers calved after 1st January..........1860.

EXTRA STOCK.

Medals will be offered for the following Extra Classes of Cattle.

Oxen of any pure or cross-breed calved after 1st January 1859.
Oxen of any pure or cross-breed calved after 1st January 1860.
Oxen of any pure or cross-breed calved after 1st January 1861.
Highland Oxen calved after 1st January........................1858.
Highland Oxen calved after 1st January ....1859.
Cross-bred Heifers calved after 1st January.....................1860.
Cross-bred Heifers calved after 1st January ....1861.

HORSES

For Agricultural Purposes.

Stallions foaled before 1st January....................1859.
Entire Colts foaled after 1st January..................1859.
Entire Colts foaled after 1st January................. 1860.
Entire Colts foaled after 1st January........ ....1861.
Mares with foal at foot, foaled before 1st January 1859.
Mares in foal, foaled before 1st January ....1859.
Fillies foaled after 1st January ....1859.
Fillies foaled after 1st January ....1860.
Fillies foaled after 1st January ....1861.

SHEEP.

LEICESTER.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

CHEVIOT.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

BLACKFACED.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

SOUTHDOWN.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

FAT STOCK.

Shearling Wethers of any Cross.

NOTE.—*Ewes, Gimmers, and Wethers, to be exhibited in pens of five.*

SWINE.

Boars, large breed.	Sows, large beeed.
Boars, small breed.	Sows, small breed.

Pigs not exceeding 8 months old, large breed.
Pigs not exceeding 8 months old, small breed.

POULTRY.

Cock and 2 Hens, Cockerel and 2 Pullets, of each of the following Breeds :—

Coloured Dorking.	Game.
White Dorking.	Any other Distinct Breed.
Coloured Cochin-China.	Bantams.
White Cochin-China.	White Aylesbury Ducks.
Brahmapootra.	Rouen Ducks.
Malay.	Any other breed.
Spanish.	Black Norfolk Turkeys.
Golden Hamburg.	Turkeys, any other breed.
Silver Hamburg.	Geese.
Polish.	Capons, 3 of any breed.

IMPLEMENTS.

The Premiums for Implements will be afterwards published.

AGRICULTURAL EDUCATION.

The following Bye-Laws have been enacted under the authority of the Supplementary Charter of 1856, and in terms of the Report by the Council on Education thereby created :—

1. That in terms of a Report by the Council on Education, the following Board of Examiners be appointed :—

Science and Practice of Agriculture—Mechanics and Agriculture of the Farm—Professor John Wilson; George Hope, Fenton Barns; Robert Russell, Pilmuir; and John Wilson, Edington Mains.
Botany—Professor Balfour.
Chemistry—Professor Thomas Anderson.
Natural History—Professor Allman.
Veterinary Surgery—Professor Dick.
Field Engineering and Surveying—John Miller of Leithen, C.E., and James Stirling, C.E.
Book-keeping and Accounts—Kenneth Mackenzie, Accountant, and Peter M'Lagan of Pumpherston.

2. That it shall be competent for said Board from time to time to receive for examination, and to recommend for the Society's Agricultural Diploma, Candidates who shall have attained their 21st year, and who shall exhibit the vouchers, and pass an examination on the subjects hereinafter prescribed.

3. That the vouchers to be exhibited shall be such as to afford satisfactory evidence to the Board: 1*st*, That the Candidate has attended a farm, and been engaged in the practical operations thereof for a period of two years, or for two separate periods of not less than one year each. 2*dly*, That the Candidate has attended, for another period of two years, or for separate periods of not less than one year each, the following Classes in some seminary recognised by the Board as sufficient:—Agriculture, Chemistry, Natural History, Botany, Veterinary Medicine, and Surgery.

4. That the Candidate's knowledge of practical husbandry, and of the foregoing branches of study, as well as of Field Engineering and Surveying, Farm Mechanics and Architecture, and Book-keeping, shall be established to the satisfaction of the Board by means of a strict examination.

5. That upon a report made by the Board to the Council on Education, stating that a Candidate has exhibited the vouchers and passed the examination required, the Council shall issue, in favour of such Candidate, a diploma, bearing the corporate seal of

the Society, and certifying his proficiency in the arts and sciences connected with agriculture.

VETERINARY COLLEGE.

This establishment is conducted by Professor Dick, assisted by Dr Allen Dalzell, Dr Young, Mr Strangeways, and Mr Worthington. The curriculum embraces the Principles and Practice of Veterinary Medicine and Surgery, with Anatomy, Physiology, and Demonstrations; Chemistry; Materia Medica and Dietetics; and the general management of domesticated Animals.

Students have the advantage of assisting in an extensive practice, and of performing the different operations which most frequently occur.

Attendance on Two Courses is required before a Student is taken upon trial for diploma; the examinations are conducted by leading members of the Medical Faculty, and of the Veterinary Profession; Graduates of the College are eligible for appointment as Veterinary Surgeons in Her Majesty's Service.

MUSEUM.

The Museum, George IV. Bridge, is open from eleven till three o'clock every day, except Monday. The public are admitted on inscribing their names in the Visitor's Book. Persons desirous of preserving objects illustrative of the Vegetable products of the country are invited to transmit them to the Secretary.

MONTHLY MEETINGS.

Periodical Meetings are held in the Museum, when papers are read, and subjects in the science and practice of Agriculture are discussed. Strangers are admitted, but cannot take part in the business.

CHEMICAL DEPARTMENT

THE objects of the Chemical Department are twofold:—

I. The prosecution of Researches in various subjects connected with Agricultural Chemistry, the results of which are published at intervals in the Transactions.

Dr Anderson will be glad at all times to receive suggestions from Members of the Society regarding subjects they may consider worthy of investigation, and which will be laid before the Chemical Committee.

II. The performance of Analyses of Manures, Soils, Vegetable Products, &c., for Members of the Society, at reduced fees.

In purchasing manures, cattle foods, &c., Members are recommended, in all cases, to do so by guaranteed analysis, and to ascertain that the article delivered corresponds with it. Partial analyses, such as Nos. 6 and 7 of the accompanying List, will generally suffice to check the correspondence of the stock with the guarantee, and give an *approximate*, though not a precise estimate of its value. Where an *exact* estimate is required, a complete analysis is necessary.

Samples intended for analysis should be sent (carriage paid) addressed to Dr ANDERSON, 15 SHUTTLE STREET, GLASGOW; and when of small size, they are most cheaply and expeditiously forwarded *by post*. They should be distinctly labelled, marked with the name and address of the sender in full, and accompanied by a letter, specifying the particular analysis required, according to its number in the following List,—and, if possible, the object in view,—as, by doing so, much trouble and delay will occasionally be saved.

Much inconvenience having been experienced by persons sending samples for Analysis which had not been selected with sufficient care, and were afterwards found not to represent the average composition of the substance, it is particularly requested that the following instructions may be attended to as closely as circumstances will permit:—

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

Manures.—A large double handful of the Manure should be taken from each of *at least* five or six different bags; and if any lumps are found in it, a due proportion of these should also be taken. The whole being laid on a large sheet of paper, should be

carefully mixed by rubbing with the hand, the lumps being broken down and mixed as uniformly as possible with the powdery part. If this mixture be carefully made, a quantity of it not exceeding *two ounces* will suffice for the analysis. It should be folded up in tinfoil, to prevent its becoming dry, and is most cheaply and expeditiously forwarded by post. In default of tinfoil, the sample may be wrapped in double folds of strong writing-paper. Should the manure contain stones, or be very moist, or should any difficulty be experienced in making a uniform mixture, it is desirable that *two or three pounds* should be sent.

Soils.—In selecting Soils for analysis, five or six spadefuls should be taken from different parts of the field, and, after being spread out in a thin layer for several days to dry, should be put two or three times through a fine sieve, so as to insure uniform mixture. For a complete analysis, not less than *four pounds* should be sent; for a partial analysis, three or four ounces will be sufficient.

Waters.—For the complete analysis of a Water, from *two to three gallons* are required; for the determination of the amount of salts in solution, and lime thrown down by boiling, *two quarts* will suffice. A well-water may be selected at any time; but the water of a spring or running stream should be taken in dry weather. The jars or bottles in which they are sent must be tightly corked and sealed. In the analysis of a mineral water, it may sometimes be desirable to determine the amount of gases held in solution; in which case certain precautions must be observed which require the presence of a chemist at the spring.

Limestones, Clays, Ironstones, &c.—If the bed of any of these substances of which the analysis is required be very uniform in appearance, a piece of two or three ounces weight, taken from any part of it, will be enough for analysis; but in all cases it is better to send three or four chips from different parts of its thickness. Sometimes, where the characters of different parts of the bed vary much, separate analyses of these portions may be requisite, in which case two ounces of each may be sent.

The following are the rates at which Analyses, &c., are furnished to *Members of the Society*, and it is requested that the fee be remitted along with the sample:—

1. Complete analysis of a Soil, including determination of Alkalies and Phosphates, £3.
2. A partial analysis of a Soil, such as the determination of the quantity of Organic Matter, and relative proportion of Clay, Sand, and Carbonate of Lime it contains, 10s.
3. Quantitative determination of any one ingredient of a Soil, 7s. 6d.

4. Complete analysis of Saline Manures and other substances, such as Gypsum, Nitrates of Soda and Potash, Ammoniacal Salts, Guano, Oilcake, Bone-dust, Rape-dust, Superphosphate of Lime, £1.
5. Testing the above substances for adulterations,—for each sample, 5s.

   This examination is generally sufficient to determine whether or not any of these substances are grossly adulterated, but it gives no idea of the comparative value of different Samples, where all are genuine.
6. Determination of the percentage of Phosphates and Ammonia in a Guano, 10s.
7. Determining the quantity of Soluble and Insoluble Phosphates in a Superphosphate, 10s.

   This and the preceding determination generally suffice to show whether the sample is of fair quality, and corresponds with the analysis by which it was sold, but not to fix its exact commercial value.
8. Complete analysis of Limestones, Marls, Shell-sands, &c, £1.
9. Examining any of the above substances for the quantity of Lime, and ascertaining in the same the presence of Magnesia and Alumina, 7s. 6d.

   Ascertaining the proportion of these, 2s. 6d. additional for each substance.
10. Complete analysis of the Ashes of any Plant, £3.
11. Complete analysis of a Water, £2.
12. Determination of the amount of Salts in solution, and of the Lime thrown down by boiling in any water, 10s.
13. Analysis of Tile or Fire Clay, £1, 10s.
14. Complete analysis of Roots, Grains, and other Vegetable Products, £1.
15. Examining products of Vegetation, or of the Dairy, such as Nutritive Matters in Wheat, or other grain—quantity of Butter or Cheese in Milk—5s. for each ingredient.
16. Determination of the quantity of Nitrogen in any substance, 7s. 6d.
17. Answers to letters asking advice on subjects within the department of the Chemist, 5s.

The charges for other analyses not specified in the list will be settled by the Committee of Management, with reference to the amount of work which they involve, and on a scale similar to the above.

JN. HALL MAXWELL, *Secretary*.

EDINBURGH, 6 ALBYN PLACE,
15*th February* 1861.